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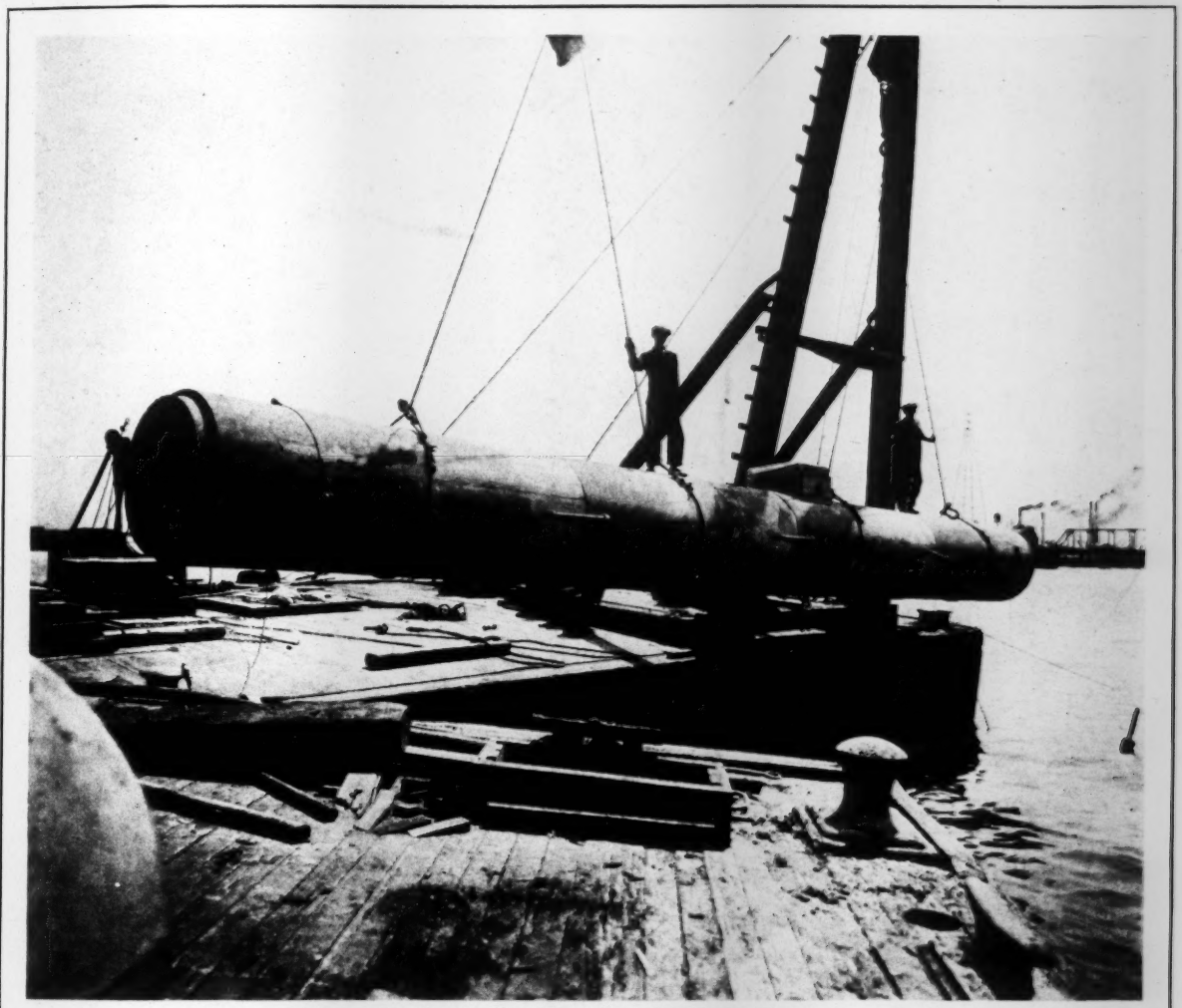
Engineering News-Record



Four Sections of Sewer Outlet Ready for Laying at Toledo

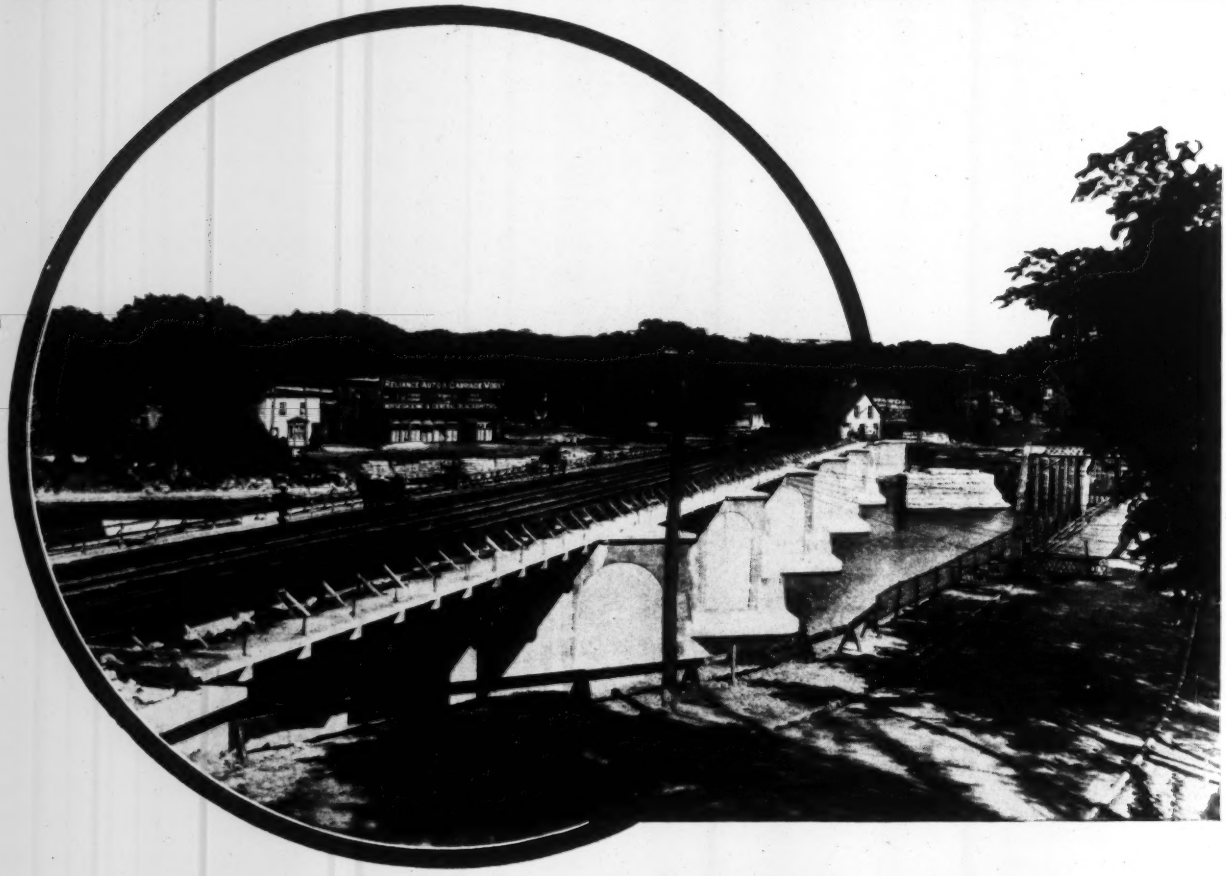
Toledo Intercepting Sewer - III: The Discharge Works

Manifold and Anchorage Combined in Pit Three Penstock

Heavy Lift Gate at Lockport Lock at Illinois Waterway

Comparative Tests of Four Concrete Piles in Seawater

KREOLITE



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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 96 NEW YORK, MAY 6, 1926 Number 18

Discovering the Beautiful

ENGINEERS lost a powerful friend in the death of Joseph Pennell. It is not of record how many of his etchings and lithographs are in circulation, but they must run into the many thousands, and of these a great proportion are the captured instant in an engineering structure or project. Beauty is in the eye of the beholder, and Pennell saw beauty where too many of our esthetes have seen only raw ugliness. Seeing it his master hand perpetuated it in black and white for the education of the masses and the confutation of the pseudo-artistic, and the engineer, too often attacked as the despoiler of nature and the worshiper of the material, has been able thereby to demonstrate that, unconsciously perhaps, he has been contributing to the graceful and the beautiful. While to do this is not the engineer's function, not to do the opposite surely is an obligation. Pennell proved that this obligation has been satisfied.

Down to the Sea in Ships

A FEW days ago the original rotor ship, the "Buckau," now called the "Baden-Baden," started from Kiel to cross the Atlantic Ocean to America on its maiden voyage. Meanwhile, Herr Anton Flettner, the designer of the ship, has come to this country to lecture on the advantages of the new method of propulsion which is used in his rotor ship. He has come, however, not on the little ship which he built and which now is slowly working its way across the Atlantic, but rather upon one of the big ocean liners. This seems a curious procedure. Imagine Robert Fulton riding up the Hudson River by stage while his steamboat made its initial trip to Albany, or Glenn Curtiss riding in an auto along the same route while his airplane made its famous trip from Albany to New York! It would seem as if Herr Flettner's arrival in New York last week was premature. He hardly can say much about the advantages of a rotor ship in trans-Atlantic service until the "Baden-Baden," with its big curious revolving mastlike cylinders, comes sliding into New York Harbor at the end of its first transatlantic trip.

Subways and Street Obstruction

SOME of the merchants and householders along Broad St., in Philadelphia and Eighth Ave. in New York City, are complaining about the obstruction to traffic, both vehicular and pedestrian, that the subway operations beneath their streets are causing. In spite of the cut-and-cover method that is being used in both cities the flanking residents are discommoded, and where there are merchants they claim they are losing custom and money. This complaint is valid to a degree. To be sure every subway construction in time adds to the assessed valution of abutting property but there is no question that even with the most modern methods of subway construction it is more comfortable to live on and more profitable to do business on the street where no subway is built than on one where excavation and construction is under way. There has been great improvement in this matter of obstruction since the days when the first New York subway practically ruined all the merchants on that section of 42d St. between the Grand Central and Broadway. Today only in the early stages of construction is there complete closure of even a part of the street and when those preliminaries are over and the timber decking fully laid the thoroughfare, while not as smooth as a permanent way, is at least clear for its full width. Nevertheless, the fact remains that there is obstruction, both from overhead frames such as are in use on some sections of the New York work and from heavy trucks loading the spoil. This obstruction is offensive in itself to residents and is responsible for some loss to merchants. The nuisance damage from subway construction is impossible to estimate, but it should be possible to make some guess, based on statistical observation, of loss to merchants. It might conceivably turn out that, with such losses properly accounted for, the conventional type of high-level subway could profitably be replaced in some places by a tunneling operation.

Fires in the Oil Fields

IN THE month of April four great fires occurred on oil tank farms in the West and Southwest which constitute the greatest disaster of the kind within the history of the oil industry. The loss involved in the first three fires is estimated at more than $10,000,000; the fourth fire was burning a 500,000-bbl. tank and menacing others much larger as this was being written. It is not easy to start fires in tank farms, particularly where only low-grade oil is stored, and under the precautions ordinarily taken by oil companies there is but little danger from the risks common in other industries. Lightning is not a preventable cause, however, and it is as much of a menace to the low-grade oils as to the most highly volatile forms; at least three of the four April fires were started by lightning. There will, therefore, always be the problem of preventing the spread of oil fires. The greatest danger comes when the heat of the fire causes the reservoir to boil over and a river of liquid burning with intense heat flows out to menace the entire oil field or tank farm. The earth dike is the form of protection most frequently used to retain a flood of this sort but dikes may not be feasible or they may not be effective, especially as lightning is the accompaniment of downpours that may well wash out earth embankments. Just such a washout did occur in one of the recent fires. Controlling the flow of burning oil and protecting adjoining structures or oil reservoirs is decidedly an engineering problem which is far from solved.

Federal-Aid Common Roads

FEDERAL-AID roads completed and under construction as of Dec. 31, 1925, from 1916 when federal aid was inaugurated, have cost $1,227,032,854 and aggregate 62,994 miles. From an analysis made by the Portland Cement Association it appears that concrete roads account for 43.4 per cent of the cost and 21.4 per cent of the mileage. These figures are certain to offer a handle for the grasp of those critics of federal-aid policies who contend that the "common road" is getting scant consideration while government money goes into speedways for the tourist and the moneyed bus- and truck-transport companies. Quite the contrary is the fact. As the records show, about 70 per cent of the mileage of highway built with federal aid is of a type lower than waterbound macadam. These roads account for 36 per cent of the expenditure. The mileage of gravel roads alone is 37.1 per cent of the total. Their cost has been 21 per cent of all roads. Graded and drained dirt roads account for 21.2 per cent of the mileage and 9.8 per cent of the expenditure. Compared another way federal-aid roads of waterbound macadam and inferior types have cost some $441,208,005 and aggregate 43,387 miles, while roads of bituminous macadam and higher types have cost $731,240,701 and aggregate 19,458 miles. It will always be a bone of contention whether fewer or more paved roads shall be built with federal aid, but charges that the officials of public roads are failing to consider the common road in distributing their gratuities are confounded by the figures quoted.

Concrete in Sea Water

CAPILLARITY and evaporation are rated as the agents most destructive to reinforced concrete in sea water in a report covering tests on concrete piles made recently at Los Angeles harbor, abstracted elsewhere in this issue. The tests were made as a preliminary to carrying out a waterfront construction program so no long period of observation was possible but by supplementing the tests on newly-made piles with extended observation of old concrete structures the scope of the investigation was materially broadened. The laboratory tests did not develop anything particularly new nor, for that matter, did the testing of the full sized piles except perhaps in the comparative size and extent of cracks in the several types tested. In the observations, however, some very logical conclusion are drawn from the fact that old piles seriously damaged at water level were still sound below that level.

Starting with the rather disconcerting suggestion that most piles have a large number of small cracks by the time they are driven, the report undertakes to show that even cracks that cross the steel do no harm if there is in them no circulation of air or water. Whether this condition holds true indefinitely is beside the point. The real issue now is that concrete piles disintegrate just above the water line so much more rapidly than anywhere else that the pile may be very seriously weakened there while still sound elsewhere. The immediate problem confronting the engineer, therefore, is what to do by way of providing the initial protection needed at water level. The use of galvanized reinforcing suggested in the report is already being tried but the two or three years in which it has thus far been in service are insufficient to show whether it is wholly successful. Bars have been bent in farther at the water line to give them a greater thickness of protecting concrete. Smaller diameter bars have been advocated for this part of the pile to decrease the area on which the pressure of corroding steel is exerted. And finally in one of the types tested a separate collar in the wind-and-water area has been provided. All of these expedients merely serve to make more difficult the entry of the oxidizing water to the vulnerable steel and they do not presuppose any chemical action to speak of on the concrete itself.

This is merely in line with the later ideas regarding the behavior of concrete in sea water. Much theory has been developed as to the chemical reactions of concrete exposed to the salts of the ocean, and as a result cements of a different composition than the standard portland have been advocated and various integral compounds proposed, all with the idea that there would be set up a resistance to the chemical reactions which were supposed to cause the breakdown of the concrete structure. Inspection and experience are tending to show that this is of minor importance, that in well made, dense concrete there is little physical breakdown due to chemical action, and that the failures are mostly due to physical action, either in the way of actual battering of waves and flotsam and ice, or to the expansion of the concrete due to entry of water into pores with ensuing freezing in cold weather, rusting when steel is reached, or saline expansion when the concrete is so porous as to allow sea water in quantity to the interior.

The remedy in unreinforced concrete is plainly a very dense concrete and where the mass is great and the design proper there is small chance of any but minute surface cracks which are not apt to penetrate to a dangerous distance. With thin reinforced-concrete sections the problem is to keep the water from the steel, and to meet this problem no one has been able to propose anything better than is concluded by the Los Angeles engineers as the result of their tests. The capillary condition of concrete is not too well understood, so the way to insure against the capillary action noted in the tests is none too clear, but when it is recognized that this alternately wet and dry section of the structure is the only part that need give concern, proper precautions in the making of the concrete being assumed, the problem at least is simpler than when it was thought that there was in sea water some virulent poison that destroyed concrete.

Motor Bus and Truck Line Problems

SOONER or later governmental regulation of interstate motor bus and truck lines must be imposed. Just as the evils of unregulated interstate rail traffic brought about the Interstate Commerce Act, so the growing motor transport will in time develop similar evils that call for control. The difficulty now lies in determining just what agency should assume the control and the degree to which the control should be exercised. If the Interstate Commerce Act is constitutional, and it of course is, it would seem obvious that its authority could readily be extended to other forms of organized transport, but the multiplicity of interstate motor lines, their wide distribution and the compara-

tive shortness of most of the hauls make the mechanics of federal control very complicated and expensive. Whether the end justifies the means at the present time is subject to doubt, particularly if the state public utility commissions exercise their undoubted right to control the lines inside the state borders. When and if these agencies become unable to exercise proper restrictions the federal authority may well be called on, but that time does not appear to be here as yet.

It must be admitted, however, that in some of our large urban centers the problem is serious. State lines are never very far from our big Eastern cities, and in the last year there has been a tremendous increase in the number of motor bus lines connecting and entering these cities. Many of these originate outside the state where the city is located and their operation as through lines is therefore not amenable to the laws of any one state. Yet they impose a great burden on the cities which they enter in the way of street congestion both when moving and parked. Midtown New York, for instance, is cluttered up with motor buses, which come in from all directions from the outlying suburbs in New Jersey and Connecticut. Even if it is not as yet necessary to impose certain regulations as to rates, the city certainly will soon have to take some measures to place such vehicles in a different category from the ordinary casual automobile from outside the state. Here is a problem the cities will have to work out themselves. It is not one ordinarily thought to come under the purview of a federal body.

An added complication has come up in the matter of the new vehicular tunnel between New York City and New Jersey and the new Camden bridge between New Jersey and Pennsylvania, both being built by interstate commissions. Bills before Congress provide that regulation of traffic through and over these crossings shall be vested in joint action of the respective public utility commissions, by virtue of the interstate compact provision of the federal Constitution. This seems to be adding unnecessarily to the mechanics of control. The interstate commissions which are building the bridge and tunnel are responsible for the financing of these structures, which means insuring their proper amortization. To add another interstate body to this control means a confusion of authority, with no commanding advantage gained.

The real problem of the motor line is not so much the rates charged as the proper return to the state for the wear on the highway. So long as the government controls rail rates, motor rates will be kept in reason by rail competition. But the motor line will make its rate, not with regard to its profits, but just enough below or above the rail rate to attract business and that rate may well damage the railroad which has to build and maintain its right-of-way. Taxing the motor, therefore, for its proportionate use of the highway seems only fair. It is only proper to say that the motor interests claim that this tax is already imposed, but their figures are not specific but are based generally on the total contribution of the motors, both public and private, to the cost of government. Much remains to be done in the study of the proper allocation of the burden of highway construction which should be borne by those private interests that are selling to the public, at a profit, their use of those highways.

Less Theorizing on Transit

PRESSURE of population is slowly convincing the whole metropolitan district of New York that it has a traffic problem which cannot be settled by the city of New York alone. Suburban transit has become an issue involving ten or more million people in three states and separate groups of those ten million have been getting more and more concerned with a proper solution of the problem. Within the last two years at least eight reports or plans on the subject have been published. Two are by an agency of the Russell Sage Foundation, two by the New York State Transit Commission, one by the New York, Westchester & Boston Railroad Co., one by a special body appointed by the state of New Jersey and one each by similar bodies set up by the state of New York and the county of Westchester. No single problem in the district has aroused such interest.

These reports do not all deal with the whole problem. As a general rule most of them either are so general or attempt to be so comprehensive as to operate against their practical application to present-day needs. Some are merely attempts to outline fundamental principles, but frequently they are a curious mixture of fundamental principles and detail drawings of some of the proposed structures. Most of the plans for a solution in one section of the district pay little attention to their part in the whole suburban transit question.

The two most recent reports, noted in this issue, contain more encouraging signs. Both give consideration to most of the other plans for dealing with the suburban transit problem and although the report of the New York State Suburban Transit Commission does not show it, its hearings have done much toward arousing interest in co-ordinating the various plans. The Westchester commission's report goes still further. It not only presents a brief critical discussion of each of the various plans, but it also has worked out its plan with the idea of the main trunk of the Westchester system becoming part of a general system for the metropolitan district. The report also takes into consideration the practical advantages that may be gained from using existing facilities which are not used to their capacity, such as the four-track B.M.T. Broadway subway and the two crosstown subways which now are dead-ended near the center of Manhattan Island and apparently could readily be extended to New Jersey.

It is time that this dispersed activity be concentrated so that there will be some prospect of action. The need for continuing study is all too evident, but at present no one body is capable of dealing with the whole problem because three states and many municipalities are affected. This, however, is no real obstacle. New York and New Jersey have found it possible to set up an interstate body to handle matters relating to the port, and another to build the interstate vehicular tunnel. There is no reason why a similar body cannot be set up to deal with the suburban transit problem, into which Connecticut also enters in a degree. Some co-ordination of new construction is obviously demanded. New York City's transit authorities will never provide it, because unfortunately all city bodies seem to consider the city line a Chinese wall. But there has been enough of local theorizing.

Toledo Intercepting Sewers—III: Discharge Works

Pumps Discharge Through Submerged Concrete Outlets—Grease Removed as Elliptical Skimmer Takes Out Floating Material

By Harvey P. Jones
With Fuller & McClintock, Engineers, New York & Toledo

This is the third article on the Toledo intercepting sewer system. The first, in "Engineering News-Record" April 1, p. 526, outlined the general plan and basis for design. The second, April 15, p. 606, described the regulators and siphons and special construction features.—Editor.

SEWAGE from the Ten Mile Creek and West Side and Swan Creek districts, Toledo, the two main drainage areas west of the Maumee River, will be handled by the Bay View Park sewage pumping station. During the first years of operation this station will discharge sewage into the deep water of the river, in the boat channel, through the submerged outfall, after passing through a skimming tank for the removal of floating materials. When disposal by dilution becomes inadequate, the station will raise the sewage to treatment works.

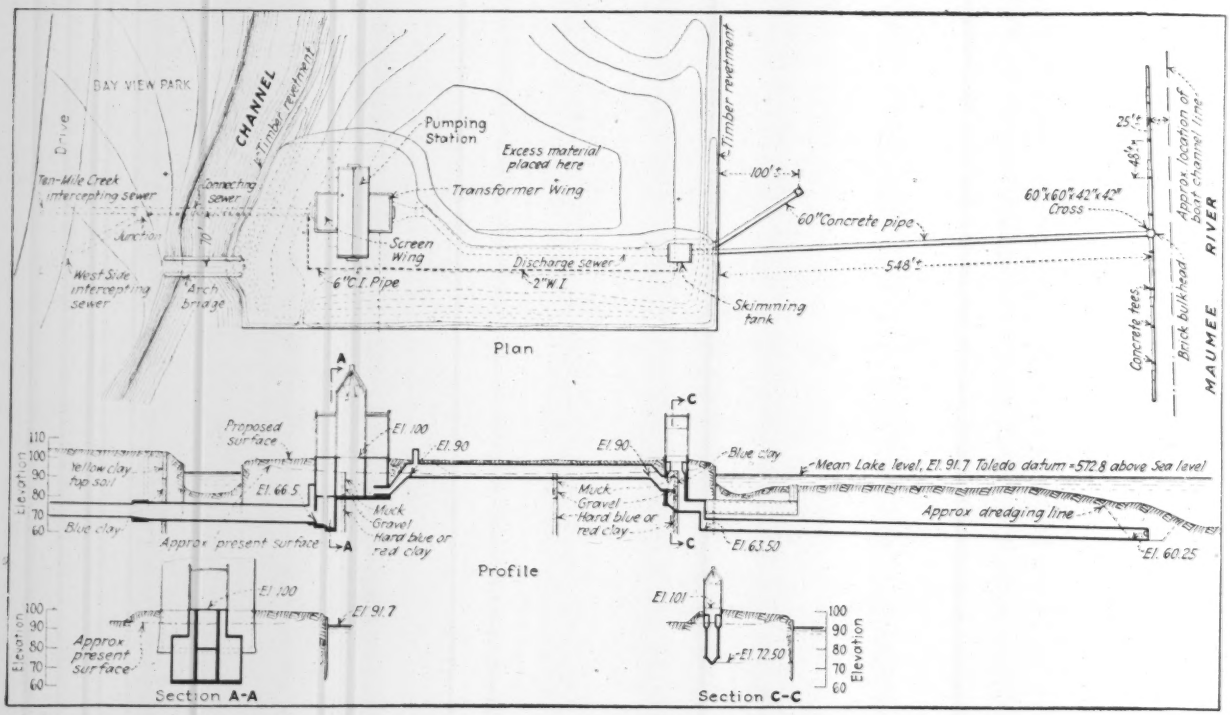

FIG. 1—BAY VIEW PARK PUMPING STATION AND OUTFALL SEWER

From the junction of the West Side and Ten Mile Creek intercepting sewers in Bay View Park the sewage is carried to the screen wing of the pumping station through a 90-in. circular connecting sewer which discharges into one or more of three channels leading to three small suction wells. The entrance to each channel is controlled by a hydraulically-operated sluice gate. Two cage screens are installed in each channel and can be raised to the ground level by means of electrically-operated hoists and counterweights. Grit which may collect in the suction wells is shoveled into buckets and raised to the surface by hoists.

The pumps, two of which have their suctions in each well, deliver through venturi meters into the discharge sewer, the invert of which is at an elevation slightly below mean water level. The discharge sewer carries the sewage to the skimming tank from which it flows by gravity through the outfall sewer. The pumping station and skimming tank are located on an artificial island near the mouth of the river, just off the main land opposite Bay View Park.

Pumping Station—The main portion of the pumping station, over the pump pit, is 35x112 ft. in plan, and each of the two wings is 27x46 ft. The pumps are installed on a floor 20 ft. below the ground level. The wing to the north houses the screens and screen equipment, the one to the south, the transformers, switchboard and toilet rooms.

Borings at the site disclosed the fact that the upper 10 to 12 ft. of soil consisted of muck and water-bearing sand and gravel. Below this depth hard blue clay was encountered. To facilitate the excavations for the pumping station and skimming tank substructures, steel sheetpiling was driven down around the site of these structures to penetrate well into the blue clay and at considerable distance back from the neat lines of the finished work. This procedure prevented the

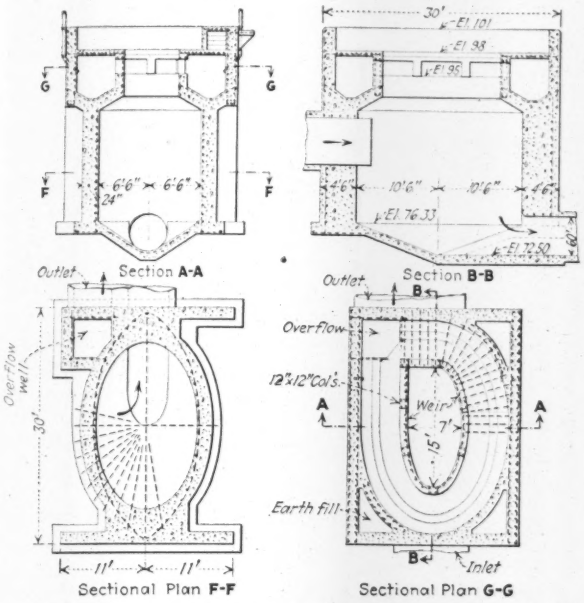

FIG. 2—ELLIPTICAL SKIMMING TANK TO INTERCEPT FLOATING MATERIAL

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The 90-in. monolithic concrete connecting sewer was constructed in tunnel, through tight blue clay, without timber bracing. Piles were used to support the discharge sewer between the pumping station and skimming tank but all other structures rested on tight blue clay and pile foundations were not necessary.

The main part of the pumping station and the skimming tank are covered with pitch roofs consisting of green tile of various shades resting on concrete slabs and concrete-covered I-beam purlins, supported by steel trusses. The wings are covered with flat roofs of concrete supported on concrete covered I-beams. Exterior face brick, in various shades running from dark red to light red, was used for both pumping station and skimming tank superstructures. Interior face brick was of buff color. Bedford limestone was used for all window sills, keystones, stone panels entablatures, belt courses, cornices and copings.

The machinery includes five centrifugal pumps, driven by 200- and 300-hp. electric motors, suction and discharge piping, electrically operated valves, electric crane, switchboard, sewage screens, hoists, venturi meters, vacuum pumps and piping and recording gages. Five direct-connected horizontal-shaft pumps of the enclosed-impeller type have been installed. Four of these pumps, when operated at normal speed and under the ordinary head, have capacities of 36 m.g.d. each. The fifth pump at normal speed and ordinary lift has a capacity of 24 m.g.d. Three of the large pumps operate at a constant speed of 485 r.p.m. while the small unit and one of the large units are operated at variable speeds. Space is provided in the pump room for the installation of another large unit in the future.

The pump-room floor is at El. 80, approximately 12 ft. below normal water level in the river. The discharge lines, after passing the meters, merge into one rectangular discharge sewer. The total lifts of the pumps in feet, including friction, are as follows:

	Ordinary	Maximum	Minimum
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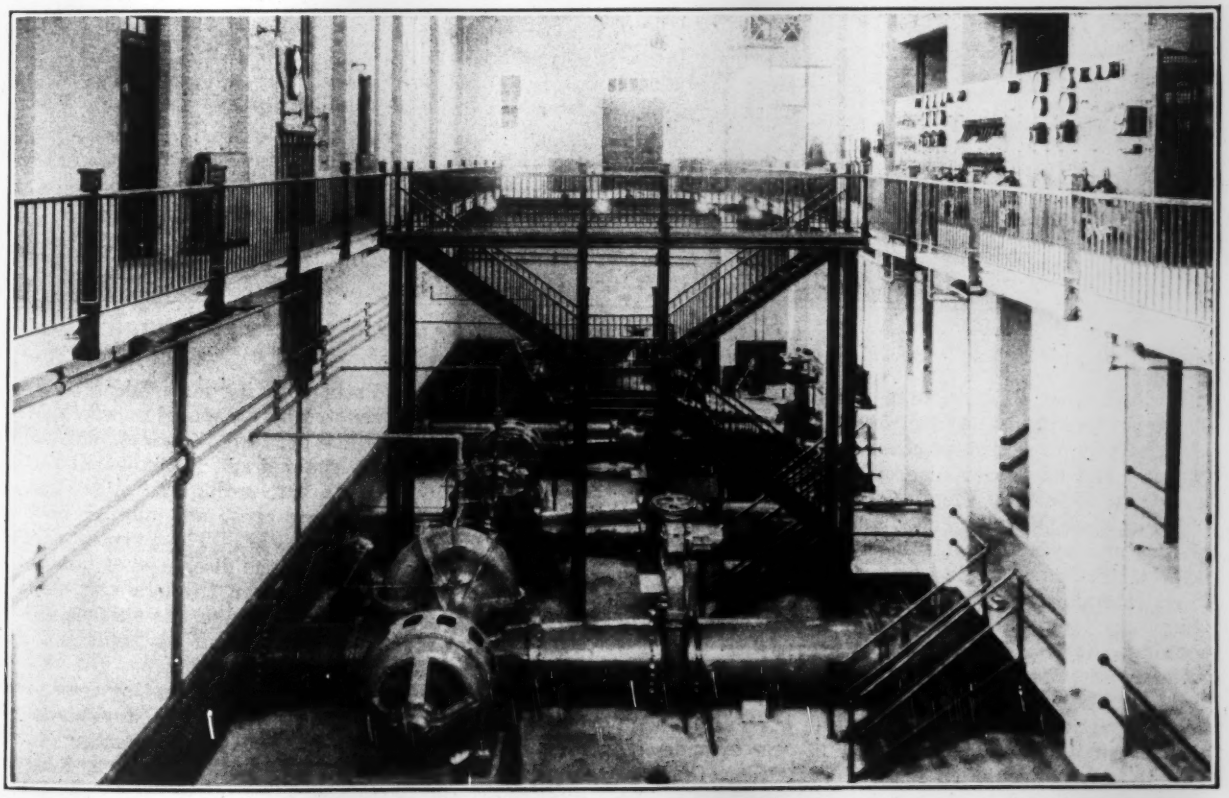

FIG. 3—INTERIOR OF BAY VIEW PARK SEWAGE PUMPING STATION

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Pumps Discharge Through Submerged Concrete Outlets—Grease Removed as Elliptical Skimmer Takes Out Floating Material

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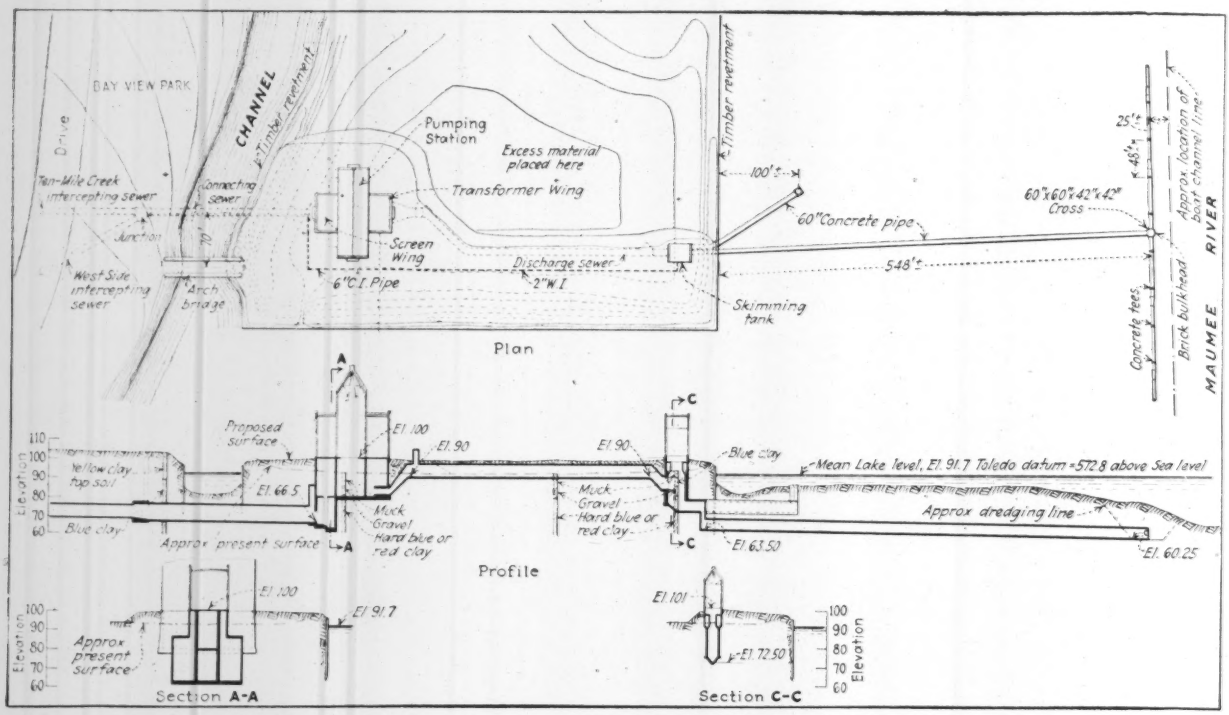

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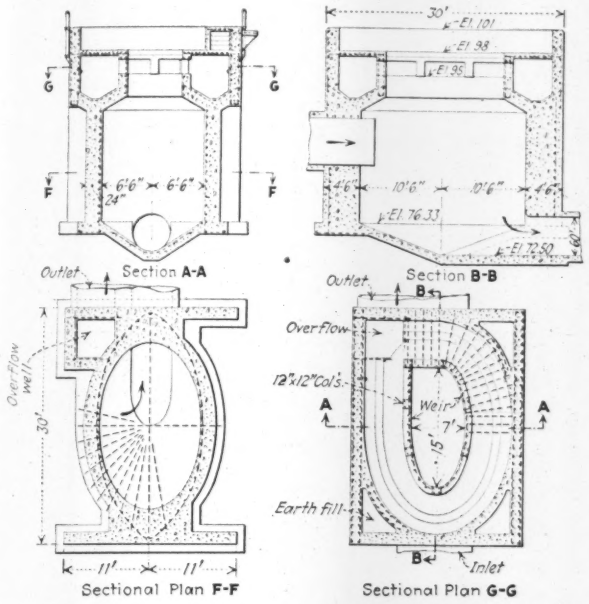

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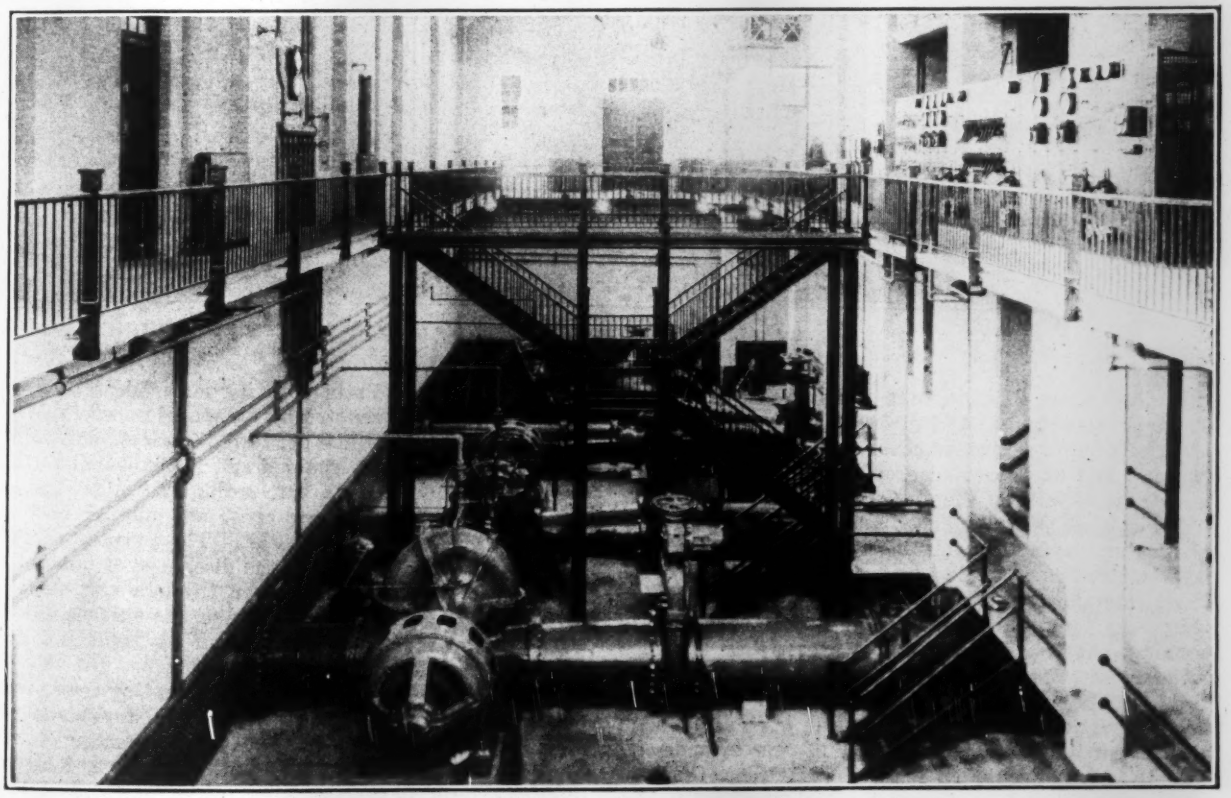

FIG. 3—INTERIOR OF BAY VIEW PARK SEWAGE PUMPING STATION

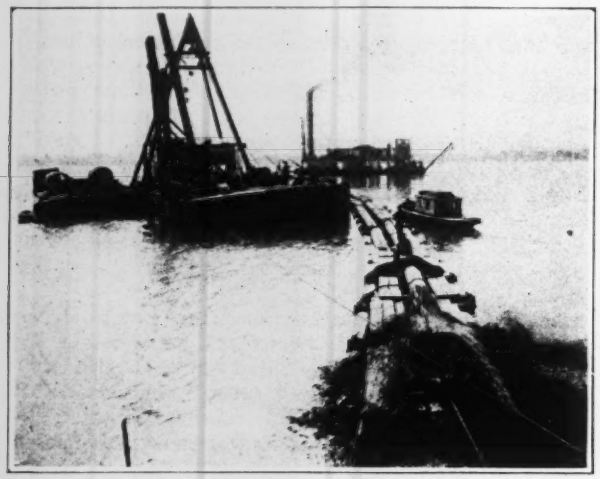

FIG. 4—DREDGING, PIPE LAYING AND BACKFILLING EQUIPMENT FOR SEWER OUTFALL

Six screens of the cage or box type have been installed, two in series in each of the three channels leading to the suction wells. The screens are built up of structural-steel shapes with two staggered rows of ½-in. galvanized pipes, 2¼ in. c. to c. The screens are raised by counterweights and electric hoists to the ground level. Screenings are removed by hand into wheelbarrows and have been disposed of by burying in the immediate vicinity of the station.

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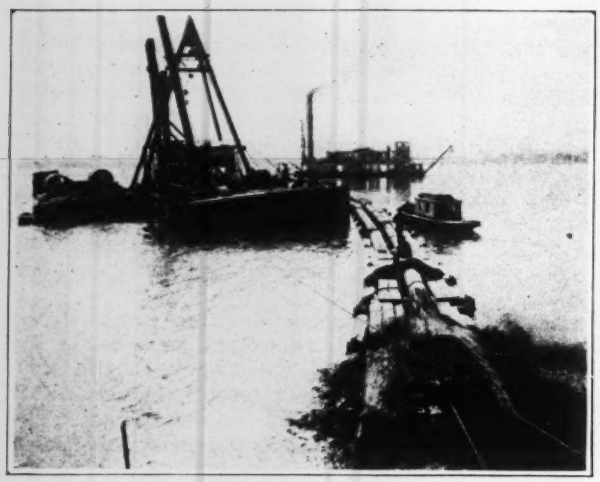

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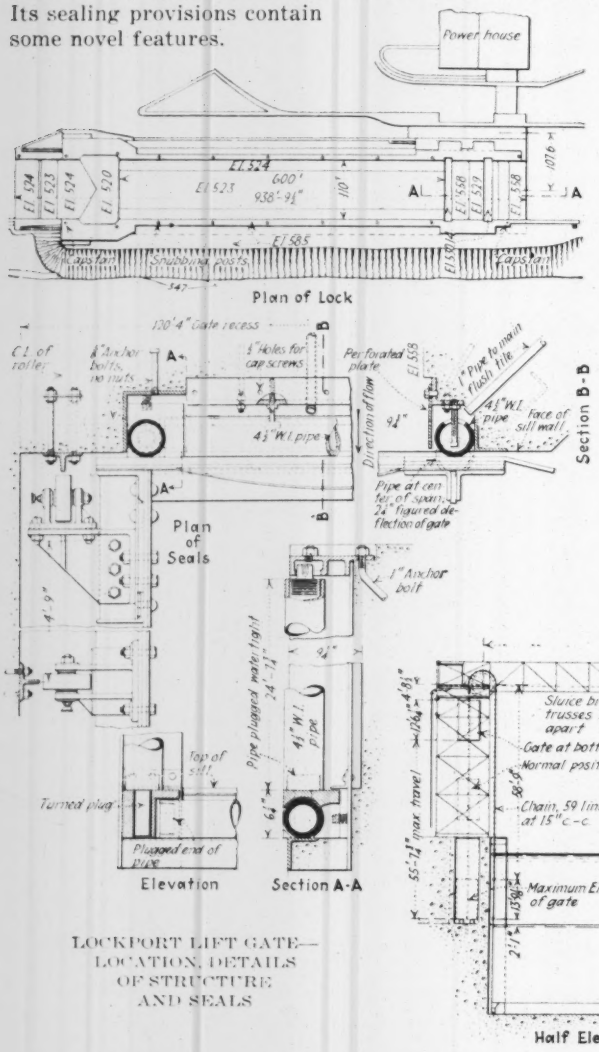
Heavy Lift Gate at Lockport Lock of Illinois Waterway

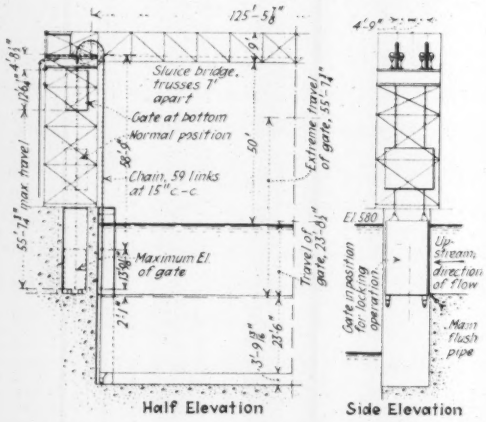
Restricted Space Alongside Old Lock Inadequate for Abutments of Miter Gates—Seals and Flushing Provisions

By Walter M. Smith
Chief Designing Engineer, Illinois Division of Waterways, Chicago

At the upper end of the Lockport lock of the new Illinois waterway, whose construction was described in *Engineering News-Record* Feb. 11, 1926, p. 228, it was necessary because of local conditions to use a lift gate in place of the usual mitering gates. This gate is very large and heavy, but of simple structure. Its sealing provisions contain some novel features.

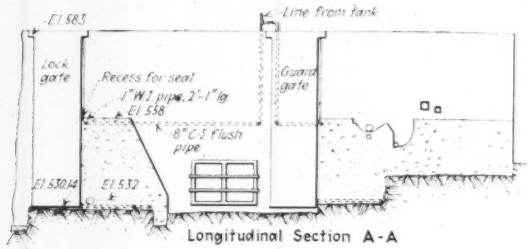


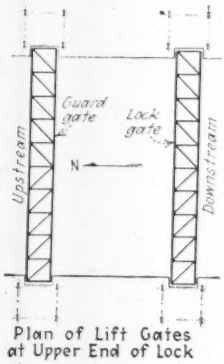
LOCKPORT LIFT GATE—LOCATION, DETAILS OF STRUCTURE AND SEALS

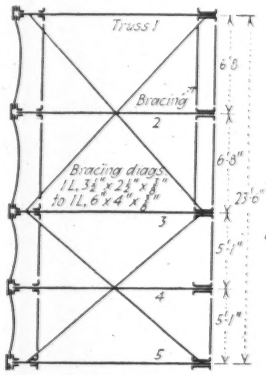


above the level of the valley, making it necessary to construct high concrete walls and embankments to maintain the water level. Upon completion of the Drainage Canal, which was built for navigation as well as drainage, the Chicago-Joliet section of the Illinois and Michigan Canal (extending from Chicago to LaSalle, Ill.) was discontinued, and a small lock, of very high lift, was constructed at Lockport. Space was provided at the same time for a much larger lock to be built later on. It is this latter that is now under construction.

In the time between the building of the forebay at Lockport and the final design of the Illinois Waterway, there was a decided increase in the preferred size of canals and locks. It was decided in designing the canal that the locks should be of the size of those decided upon by the government in the canalization of the Ohio River. The Drainage Canal builders had not planned for a lock of this size, and there was not sufficient space between the small lock now existing and the new lock to build a wall of sufficient thickness to take the thrust of miter gates. Hence miter gates could not be used.







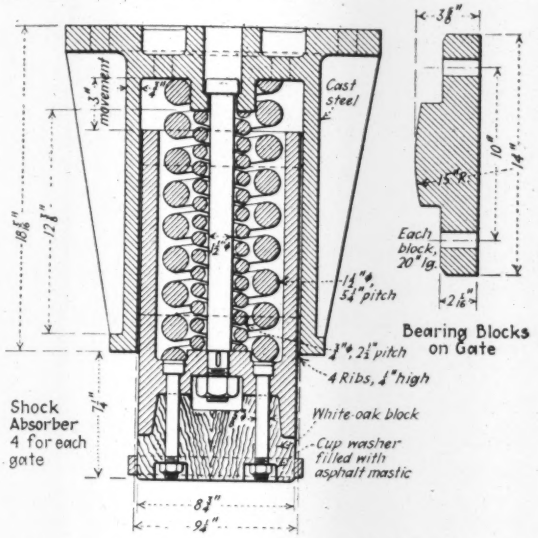
In weight and cost, the lift gate compares unfavorably with mitering gates, as the gate leaf weighs about 200 tons, against about 130 tons for the mitering gates, and the lift gate has, in addition, a pair of towers and an overhead bridge. The reasons for its use are set forth in the following:

Space Limitations—The level of Lake Michigan is carried through the Drainage Canal to Lockport, where the power plant of the Sanitary District of Chicago is located. Water level in the forebay is about 30 ft.

Further, as the Lake Michigan level, which is the summit level of the canal, is brought through to the upper end of Lockport lock, it will be seen that the gates at this point are the critical structures of the canal. The sanitary district has a butterfly dam in the Drainage Canal about 2 miles above the lock site at present, but this dam will shortly be removed. It was seen, then, that a type of gate should be provided at this place that would be hard to wreck in a boat collision, which is not the case with a miter gate. These considerations rendered some style of girder or truss gate imperative. The lift type was

therefore adopted. As the width of the lock, 110 ft., makes the load on the gate too heavy for plate-girders to be economical, the gate structure was made of trusses, with a buckle-plate skin on the upstream side.

Advantages of Lift Gate—When girder lock gates are used on the government locks they are generally designed to roll horizontally into a recess in the side wall to open the lock. This type was not economical at this site, on account of the great amount of high concrete wall it would take to build the gate recess. There was another important reason for deciding upon the type finally adopted. A counterweighted rising gate, or Stoney gate, can be lifted entirely out of the water whenever it needs to be inspected and for minor repairs in the winter time, when the canal is closed to navigation. The extra clearance of the overhead bridge to



SHOCK ABSORBER USED IN LOCKPORT LIFT GATE

allow this caused no additional expense, as the government engineers required the clearance for other reasons.

Two gates are provided at the upper end of the lock, one for locking vessels through and the other as a guard gate. The latter will normally rest in the lowered position behind the sill wall, the culvert entrances being between the two gates. The gates are identically alike, so that in case of serious damage to the service gate the guard gate can be moved into the position of the service gate and used for locking.

Operation—An overhead bridge above each gate is carried by steel towers resting on the lock wall. Each tower has a heavy platform at the bridge level, on which are mounted two very heavy cast-steel sprocket wheels. A heavy sprocket chain passes over each wheel, one end being attached to the upper corner of the gate and the other to a heavy concrete counterweight traveling in guides in the tower. The sprocket wheels are driven by a motor on the bridge. The gates are counterweighted, so that the motor will have to overcome only the friction of the machinery and gates.

As the gates are not to be operated under pressure, no rollers are provided where they bear against the masonry as is generally the case in Stoney gates, but heavy cast bearing blocks are bolted on the face at the ends of each truss to bear against a heavy steel rail bedded in the masonry, when the gates are under pressure.

The gate itself is a very simple structure, consisting of five horizontal trusses with a buckle-plate skin on the upstream side for watertightness. But there are a few special features that are interesting.

Seal—In the ordinary process of locking, the gate is lowered behind the sill wall on the downstream side and the vessel passes above it. The water seal is therefore on the upstream side, and as the gate deflects about 2½ in. under full pressure the method of providing a suitable seal was quite a problem. A groove was made along the downstream edge of the sill opposite the lower girder of the gate (with gate closed). Both edges of this groove are bound by steel angles attached securely to the masonry. A wrought-iron pipe made continuous for the entire length of the gate by inside screw couplings lies in this groove, and is held from falling out by T-head bolts at intervals, the T-head being placed inside the pipe through a slot and the bolt then screwed into the angle at the back of the groove and locked in position by a lock nut. These bolts are sufficiently long to allow the pipe to follow the gate when it deflects, but they prevent it from falling out of the groove when the gate is raised for inspection. A perforated plate is bolted over the top of the groove. At the ends of the gate the pipe fits into a recess in a special casting that has a projection on the top side over which fits a vertical pipe, carried in a vertical groove formed by a steel angle in the corner of the side wall. The vertical pipe is held only at the top and bottom ends.

Shock Absorbers—To each of the lower corners of the gate a shock absorber is attached. This consists of an outer cylinder of cast steel with a thick flange at one end by which it is bolted to the gate, and an inner cylinder of the same metal fitted loosely to slide inside the first and a bolt connecting the two together on the center line. Around this bolt are two coil springs, an inner one of ¾-in. and an outer one of 1½-in. spring steel, holding the two cylinders apart to the length allowed by the bolt. The inner cylinder has a diaphragm near the lower end, and below this diaphragm an oak block is bolted that rests on the sill with gate down.

Flushing System—A flushing system for the seal groove is supplied from a tank on the platform of one of the towers. An 8-in. cast-iron pipe is placed in the sill about 2 ft. from the groove that carries the horizontal seal pipe. At 2-ft. intervals a 1-in. wrought-iron pipe connects this pipe with the back of the groove. By opening a valve the water from the tank under about 70-ft. head flows into the groove, and any mud or other deposited material is washed out through the holes in the cover plate and the space between the plate and the gate face.

The method of keeping clean the sill on which the gate rests is as follows: A 30-in. vitrified pipe is placed in the masonry about 2½ ft. back from and just above the level of this sill. At about 2½-ft. intervals 4-in. pipes lead from this pipe to the upstream edge of the sill. The large pipe is connected to the culverts in both walls, so that whenever the culvert gates are opened to fill the lock, the water rushes through the pipe and out over the sill under almost 40-ft. head, decreasing as the lock fills.

The lock is being built by the Division of Waterways of the Department of Purchases and Construction, State of Illinois. Leslie Small is director and William F. Mulvihill superintendent of waterways. Mortimer G. Barnes is chief engineer, L. D. Cornish assistant chief engineer, and the writer chief designing engineer.

Arkansas Clears the Way to Sanity in Road Improvement

New Laws and Better Road Education Assist State To Overcome Troublesome Legacy Left By Improvement-District Mania

Arkansas is emerging from her incubus of irresponsible and misdirected road building. Bankruptcy, confiscation, repudiation, speculation and the chastening lack of denied federal recognition have all played their part in bringing new legislation and new thinking and may be forgotten. The matter of importance is that old practices and old thinking are being broken away from. The story is quite worth telling and is here given as learned from a study on the ground by a member of the editorial staff of Engineering News-Record.

STATE highway work in Arkansas has been much in the public eye. Due to a constitutional restriction against the issuance of bonds for public works construction by state, county or municipality, the state several years ago suffered greatly because of the existence of the ubiquitous road improvement district. Though the formation and administration of these road improvement districts have been explained in detail in these pages before, because the history of highway development in Arkansas revolves about them, some resumé of their activities is necessary here.

Let it first be said that Arkansas is fast emerging from what appeared, but three years ago, as an almost hopeless situation. The highway department is now building up throughout the state respect for central control of highway matters. And though legislative restriction still exists against bond issues for needed construction, the highway department is proceeding with all possible speed in mending a badly shattered highway system.

Though a highway department was organized as early as 1913, it was combined with the department of state lands and little was done in the construction and maintenance of principal routes of travel. The first organization was given a fund derived from a $10 license fee on motor vehicles. In 1915 a law was passed authorizing the establishment of road improvement districts, inasmuch as there was a general clamor for better highways and no possibility of the state's raising by bond issue funds to meet needed construction costs.

History of Improvement Districts—There were two general methods of organization of the improvement district: (1) Under a general legislative act providing for formation of the district with the approval of the county court wherein the district was located; and (2) by a special act of the legislature. In the latter method the bill which was introduced into the legislature actually defined the physical limits of the district and the road or roads that were to be improved. After the act had been passed it was or was not referred to the people included in the district for approval. The bonds which these improvement districts could issue were limited to 30 per cent of the valuation of the real property within the district.

Following the authorization for their creation road improvement districts sprang up all over the state. To what extent can be best judged by the statement that during the 1919 and 1920 sessions of the state legislature 457 bills passed, creating as many districts. The state engaged upon an orgy of highway construction wherein there was little reason or good sense. Co-operation between the state and the federal government became well-nigh impossible, because of the fact that federal laws are based on direct contact between the federal government and the state highway department, and no recognition was given the improvement district or the county. In turn, the state highway department had no control or direct supervision over work being done by the improvement districts.

Government Interferes—Early in 1923 the Secretary of Agriculture, because of these unsatisfactory conditions of control, and because of poor or total lack of maintenance of projects completed under the improvement district plan, refused to allow the state to participate further in federal aid until the conditions had been remedied. The secretary required, before federal participation could be recaptured, enactment of state laws that would give to the state highway department direct control over construction done by districts, place maintenance of the state system under the control of the state, and relieve the land owner of part of the cost of road construction. A special session of the legislature met in October, 1923, and passed an act which met all of the requirements of the Secretary of Agriculture. The passage of this new act removed many of the obstacles that had rendered co-operation difficult between the state and federal bureau, and designated, for the first time, a definite state highway system. At its regular meeting in early 1923 the legislature had found highway matters too complicated to attempt any settlement, and it was not until the special session in the fall, and after the Secretary of Agriculture had issued his ultimatum, that an agreement was reached, and some order restored out of the chaotic condition that had prevailed for a number of years.

It is only since early in 1924, then, that the Arkansas State Highway Department has really been functioning with full powers over construction and maintenance. With the feverish road building that had been going on with practically no state supervision nor maintenance, and as every road improvement district had hired its own engineer, it is easy to picture the task that the state highway department faced upon its organization as a sound, centralized and authoritative body. The state system was composed of numerous disconnected improvements as well as a large mileage of roads that were little more than trails. Roads built by the improvement districts, except in a few cases, had been subjected to heavy traffic for one to five years with scarcely a dollar spent on maintenance. This condition was brought about partly through neglect and partly by an absolute lack of funds for maintenance work as the improvement districts had only construction in mind when they were organized. The state highway department was then immediately confronted with the problem of placing these neglected and worn-out improvements in the best condition possible with the small fund that was available. Although a large amount of work has been done since 1924, the state highway system still presents an extraordinarily spotty aspect, and the reconstruction and constructive work of the department has only begun.

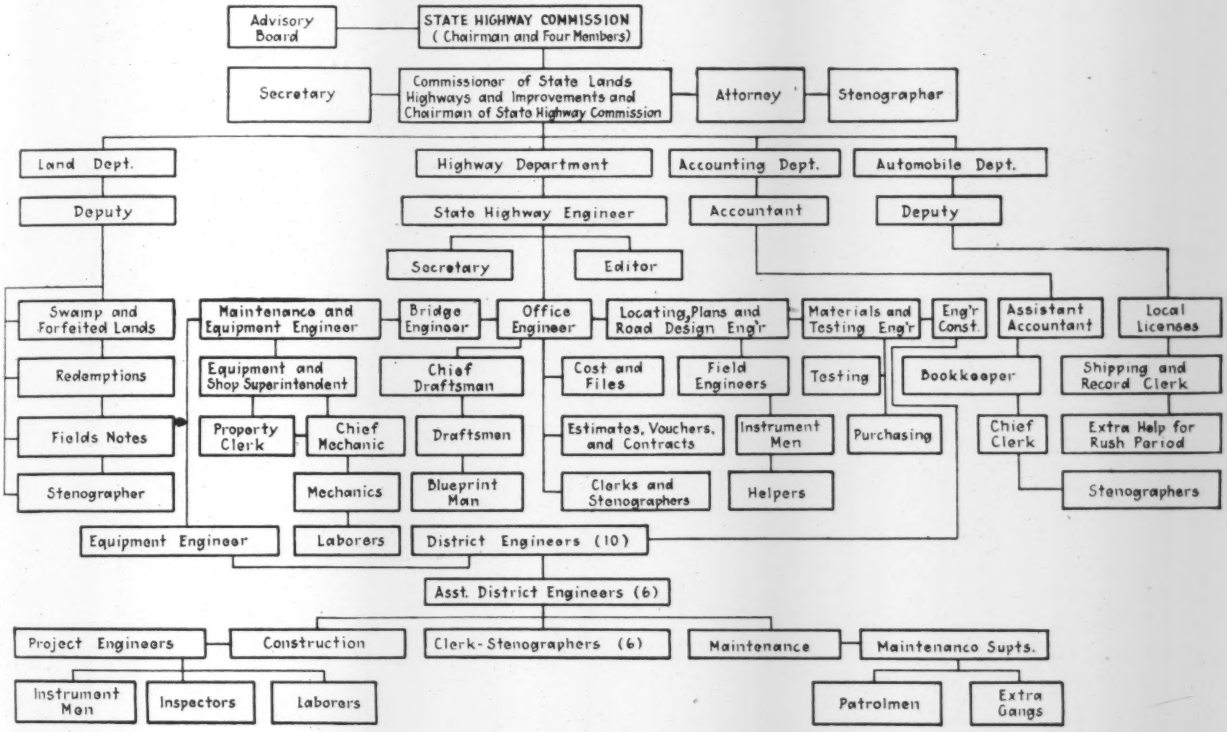
Although, as previously stated, a state highway department had been created in 1913, the department was really organized in 1917, immediately after the

passage of the Federal Aid Highway Act. By the 1913 act the state highway department was made a bureau in the department of state lands, highways and improvements. This act provided that the commissioner of state lands be commissioner of the new department and ex-officio chairman of the state highway commission. As shown in the accompanying chart, that form of organization still endures, though the highway commission now is the chief body. As previously stated, the only funds provided were secured by a $10 license fee on motor vehicles. The salary of the commissioner was fixed at $2,500 and that of the highway engineer $3,000.

The next important highway legislation was that concerned with the formation of road improvement districts, explained above. Following the passage of the Federal Aid Highway Act two years later, additional state legislation was enacted whereby the state highway department personnel was enlarged and federal-aid funds could be legally taken up. At this time—the 1917 session—an advisory board was created for the purpose of recommending to the state highway commission the apportionment and distribution of both state and federal funds. This board consisted of the state highway engineer, the professor of engineering at the state university and a third member appointed by the governor of the state. In that year an appropriation of close to half a million dollars of the highway improvement fund was made for state aid to counties and road improvement districts, and to enable the state to meet requirements of the Federal-Aid Act.

About this time the post-armistice optimism, that had penetrated the most remote rural districts of the state, had a tremendous effect on road construction. During the 1919 and 1920 sessions of the legislature 457 bills were enacted creating road improvement districts, and the roads involved in these bills totaled about 9,000 miles. This condition was deplorable as many districts were given life that should never have been started. Also, contracts were let at the peak of prices of construction materials.

During the summer of 1920 the pendulum swung the other way and scores of attacks were made on the highway department and the program of roadbuilding in general. In consequence, a very antagonistic legislature met in 1921. This session was notable for its opposition to any constructive roadbuilding legislation. During its term but five new road improvement districts were authorized and repealing acts were passed



ARKANSAS STATE HIGHWAY ORGANIZATION

for 53 districts created by previous sessions. This might have been well and good if the destructive policy had ended there, but a decided movement gained headway to give to the counties all of the revenue collected from licenses on automobiles. Friends of the highway department had difficulty in defeating proposed legislation with that intent. As it was acts were passed which divided the license taxes 70 per cent to the counties and the rest to the state. This legislation and the state of mind which accompanied its passage have been the greatest deterrents, it is generally held, to the building up of a solid state highway department and a connected system of roads.

To offset the loss of so much money from motor-vehicle licenses, the legislature did make some changes in the motor-vehicle law and impose a one-cent tax on gasoline. But instead of more money with which to operate, the highway department had less. For the 1919-1921 biennium it had had $983,000, whereas after the 1921 legislature had met the biennium following yielded but $600,000. This sum was little more than

that necessary to pay the operating expenses of the department, with practically nothing left for maintenance.

Highway legislation remained in this condition until the meeting of the legislature in 1923. The regular session could do nothing, it decided, but after the federal government had withdrawn federal aid, the special session passed the act under which the department now operates. It gave control of construction and maintenance to the state highway department and limited the activities of road improvement districts. Inasmuch as the latter were then functioning and a large number of projects were being constructed under their supervision, it was necessary that this work be allowed to proceed. However, the amount of bonds which could be raised was limited to 50 per cent of the estimated cost of the road, the balance of the funds to be supplied either by the state or the federal government. And the estimate for the construction had to be made by the state highway department, and its figures accepted. This had the effect of keeping down to the minimum the number of new districts. Practice is now that no new districts are formed without referendum or petition. The districts that have issued bonds are still responsible for their obligations, although it is becoming more and more apparent that outside financial assistance must come sooner or later. On Jan. 1, 1925, there were outstanding some $64,800,000 in bonds. It is true that some of the older districts have exhibited sound financial responsibility and in cases are collecting federal aid accruing from back years. But it is also true that the state's highway program for several years to come will be hampered by the necessity for aiding districts that either will not or can not pay.

As a corollary to this, the original perspective has entirely shifted. In the beginning those in the improvement districts regarded the road improvement as purely a local affair. Now, with automobile travel so widespread and with so many foreign cars in the state, the districts have become convinced that the construction of a state system is state business.

As it now stands, the state has practically no construction fund because, though it had during 1924 practically a $5,000,000 income from gas and oil taxes and license fees, it is compelled to turn back to counties $3,000,000 of this amount and use $1,500,000 yearly for operation and maintenance. This left the state during 1924 but $339,000 as a construction fund, which is extraordinarily small.

The 1923 legislature also designated a highway system, giving authority to the state highway department to add mileage as it saw fit, though always restricting such mileage to main market roads. The system as at present constituted contains 6,700 miles. Of this, about 2,000 miles are unimproved, 500 under construction, 1,800 graded, 3,500 graveled, and 600 hard-surfaced, mostly with concrete and asphalt types.

Arkansas is picking up the loose ends. Its principal business is the closing up of gaps on the main roads and opening up the up-state hill country. The state highway department engineers probably have the most diversified work under their control that can be found anywhere. It is obvious that inasmuch as each road improvement district selected its own engineer and the type of highway to be built, there is no uniformity in construction type along a single highway.

In the peak of popularity of the old improvement district the state was a virgin field for exploitation by the materials salesmen and the representatives of patented pavements. Also, the type of engineering which dictated the design and directed the construction was both good and bad. Where it was good the state is not suffering from high maintenance expenditures, but where it was bad the difficulties the commission is up against are anything but pleasant.

In a number of cases where construction work is still being done under the improvement district plan, the state has hired the original engineers to complete the work. Inasmuch as the engineers took the work originally on a contract basis and the federal government forbade such practice, the state has paid these engineers liberally as employees of the department. However, upon completion of the work they will not be retained on the payroll.

The principal responsibilities of the Arkansas Highway Commission, therefore, are those concerned with maintenance and rough construction. They are doing the best they can with the available funds. Maintenance money is fairly adequate, but the construction fund is inadequate. The highway department is faced with the double problem of saving a vast investment represented by a very spotty mileage and making of these short lengths of road, scattered throughout the state, an interconnected system. From a multitude of local authorities engaging in uneconomical construction, with no thought of maintenance, there has arisen a sound policy of centralized control. And though acquisition of the knowledge has been a bitter experience, there probably is no southern state more ready to accede to centralized authority than is Arkansas. Throughout the entire state its citizens can see what lack of foresight in not providing for maintenance and lack of engineering can do to a road system. Also, the state has felt the value of federal aid both in supervision of design and construction and provision of part construction funds.

So, with even an average construction fund—and a 5c. gasoline tax in the state is possible—Arkansas is equipped to go ahead in its road-making business on a sound basis, as the sectionalism which other southern states face has demonstrated its impracticalities in the business of making roads. And though the people of Arkansas have paid dearly for their roads and will continue so to do, they assuredly will appreciate them when the system is constructed and well maintained.

Chemical Cost for Reducing Water Hardness

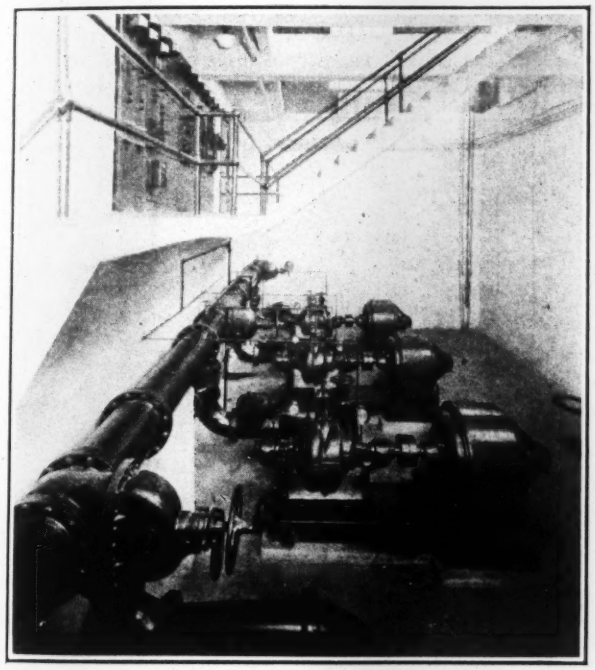
The unit cost for chemicals used to reduce hardness of the water supply of Columbus, Ohio, was 10.2c. for each part of hardness removed for the year 1925 and averaged 10.24c. for the 17 years from 1909 to 1925. The cost was at its minimum (5.2c.) in 1915 and at the maximum (15.3c.) in 1918. Hardness removed in 1925 averaged 206 (reduced from 298, with a range from 495 to 137 in the raw water). For the 17 years, 22,347,555 parts of hardness were removed at a total chemical cost of $2,388,400. During 1925, 7,769 tons of lime and 4,303 tons of soda ash were used, the cost per ton, f.o.b. Columbus, being $7.25 and $29.86 respectively. C. B. Hoover is superintendent of the Columbus Division of Water and Charles P. Hoover is chemist in charge of water purification.

New Water Pumping and Filtration Plants, Hannibal, Mo.

Electric-Driven Pumps Operated at Night—Water Formerly Coagulated, Settled and Chlorinated Only

By M. P. Hatcher
Designing Engineer, Burns & McDonnell Engineering Co., Kansas City, Mo.

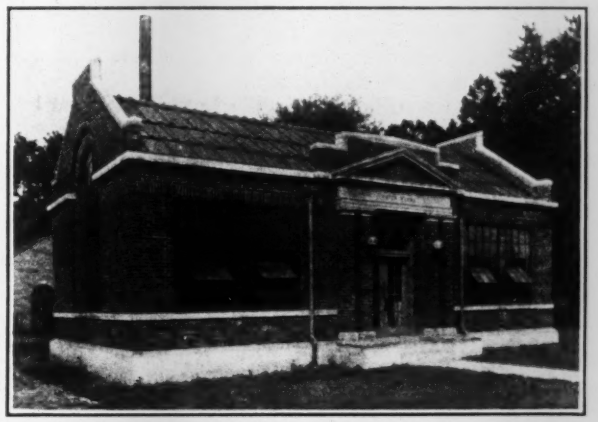
When Hannibal, Mo., the boyhood home of Mark Twain, undertook the remodeling of the supply portion of its water-works in 1924 it consisted of a 6.5-m.g.d. steam pumping plant and 16-m.g.d. lime-and-alum coagulating and settling basins with a 5 to 8-day detention period and chlorinating apparatus. The treatment works were located about 300 ft. above and 3,500 ft. from the Mississippi River, the source of supply.



ELECTRIC-DRIVEN PUMPS FOR HANNIBAL WATER-WORKS
The pump header connects at either end with a separate force main. The switchboard gallery is inaccessible to visitors.

The improvements include a new pumping station, with electric-driven pumps of 11-m.g.d. capacity, new pipe connections at the station, division of the old settling basin in half, one part for raw water and one for clear water, and provision nearby of a 6-m.g.d. mechanical filter plant. The old intake pipe, suction well and pumping station have been abandoned. Lime and alum are not applied to the water in the settling basin except for some two months in the year when the turbidity is high. The chlorination device is retained for after treatment of the filtered water. These improvements, together with extensions to the distribution system, totaling about four miles, were completed in 1925 at a cost of about $400,000. The population of Hannibal in 1920 was 19,306.

The substitution of electric for steam power was due largely to the fact that the city owns and operates an electric light and power station, which had a small load from 9 p.m. to 7 a.m. With a water consumption averaging 2.25 m.g.d. and storage capacity for 8 m.g. each of raw and of filtered water it is possible to do nearly all of the pumping at night, with little added expense except for coal. On this basis, the estimated power cost is 0.67 per kw-hr. As a partial offset to the lower power cost, extra pump capacity had to be provided to do the work in 10 instead of 24 hours. Instead of the 5-m.g.d. pump capacity that might have sufficed on a 24-hour base, 11 m.g.d., with provision for increase to

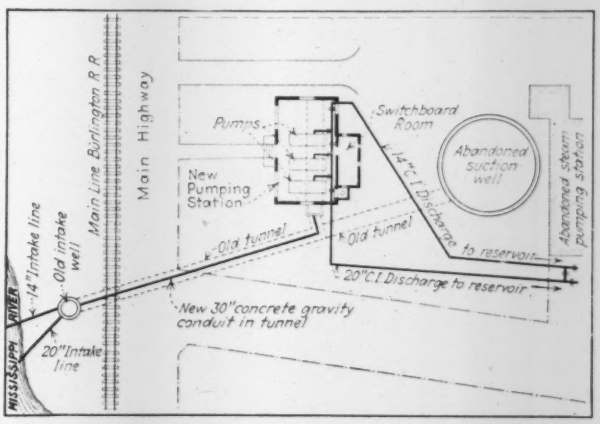


HANNIBAL WATER-WORKS PUMPING STATION
Abandoned steam plant and smoke stack in rear.

15 m.g.d., was provided. Three pump units were installed, each of 2,500-g.p.m. capacity against a head of about 300 ft., and each driven by a 300-hp. motor. A study showed that it would not be worth while to provide motors for power-factor correction through the day, with pump disconnection during the electric load period, because this plan would entail extra capital cost and extra day attendance. Unity power-factor synchronous motors, one for each pump, were therefore provided.

At first it was proposed to locate the new pumping station between the railroad and the river (see sketch) but it was found that this would entail extra cost for protection against high water and ice, would subject the force mains beneath the railroad track to vibration and require the electric feed lines to cross the track. In addition, the pumping station would be inaccessible and its site not capable of landscape treatment.

The site chosen seemed objectionable at first because the pump pit and the connection between it and the intake well would have to be excavated in shale. The



PLAN OF NEW WATER PUMPING PLANT, HANNIBAL, MO.

latter difficulty was obviated by finding that the original intake was a 6x6-ft. tunnel, in the shale, with its bottom about 6 ft. below extreme low water. This had long been filled with silt and debris. In its place a 16-in. pipe laid on the tunnel bottom was being used, but with considerable loss of head. The new intake finally laid was a 30-in. reinforced-concrete pipe about 130 ft. long, from the old intake well to the new pump sump.

The pumps discharge into a header, one end of which connects with a 14- and the other into a 20-in. force main, well separated near the station for safety, then coming near together, where a cross-connection and valves just beyond are inserted.

The switchboard is inaccessible to visitors, who look down onto it from a balcony. The board is flush with the main wall of the station and the other equipment is beyond this wall. The pumping station is fireproof throughout and is provided with a three-ton crane.

Plans and specifications for all the new works were drawn by the Burns & McDonnell Engineering Co., Kansas City, Missouri.

Uniform Aggregate Important in Concrete Control

PIT-RUN gravel aggregate cannot be used successfully for concrete, according to a paper read by Stanton Walker, director, Engineering and Research Division of the National Sand and Gravel Association, before the Grand Rapids Engineers' Club. Mr. Walker said:

The erroneous impression is sometimes held that the information developed by recent researches places unprepared aggregates on an equal footing with properly graded and separated materials That this is not the case can be shown by an intelligent study of the factors which control the quality of concrete in the field.

While unprepared aggregates, consisting of clean and durable particles, can be proportioned in the laboratory in such a manner as to produce satisfactory concrete strength, it is extremely difficult in the field to control the proportions in such a way as to obtain consistently concrete of the quality desired. They are unsuitable because of

(1) Poor grading.
(2) Poor uniformity in grading.
(3) Presence of harmful impurities.

It will be seen at once that the use of poorly graded aggregates, increases the amount of cement required, the most expensive ingredient of concrete, and that variations in grading would require constant changes in the proportions to maintain a uniform quality of concrete. The economical operation of any job depends on the establishment of a routine. Even if it were possible to anticipate changes in grading of unprepared material, and it is not, it would be impossible to establish a satisfactory routine where changes in the grading were constantly occurring. The presence of harmful amounts of organic impurities in an aggregate should, of course, at once eliminate it from consideration for concrete work. It is a rare deposit of sand and gravel which does not require washing to make it suitable for concrete. The strength of concrete may be reduced as much as 50 per cent by the presence of organic impurities in such minute quantities that it cannot be detected by visual examination.

The principal disadvantage of poorly graded aggregates is lack of uniformity.

Unprepared sand-gravels almost always contain an excess of sand, and practically always show a wide variation in grading. This is chiefly evidenced by the variation in ratio of fine to coarse, which, from my personal observations, sometimes varies as much as from 25 to 75 per cent of sand. This variation is generally haphazard to such an extent that it cannot be anticipated. Even when the aggregate occurs in fairly uniform proportions it is almost impossible with ordinary methods to handle it in such a manner that consecutive batches are uniform. With this occurring it will be seen that, even if the aggregate were well proportioned to begin with, subsequent segregation would result in some over-sanded and some under-sanded batches.

In conclusion: (1) Properly prepared aggregates almost always require less cement than unprepared aggregates.

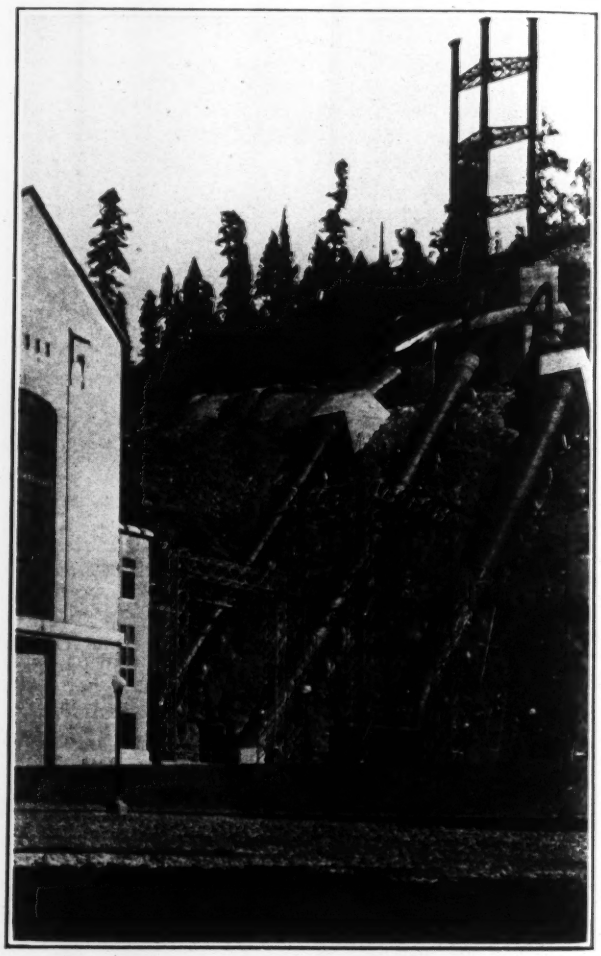
(2) The lack of uniformity of unprepared aggregates makes it extremely difficult to control the proportions in such a way as to produce concrete uniform in quality.

(3) The presence of organic impurities in aggregate should bar it from consideration for concrete work of any importance.

Manifold and Anchorage Combined in Pit Three Penstock

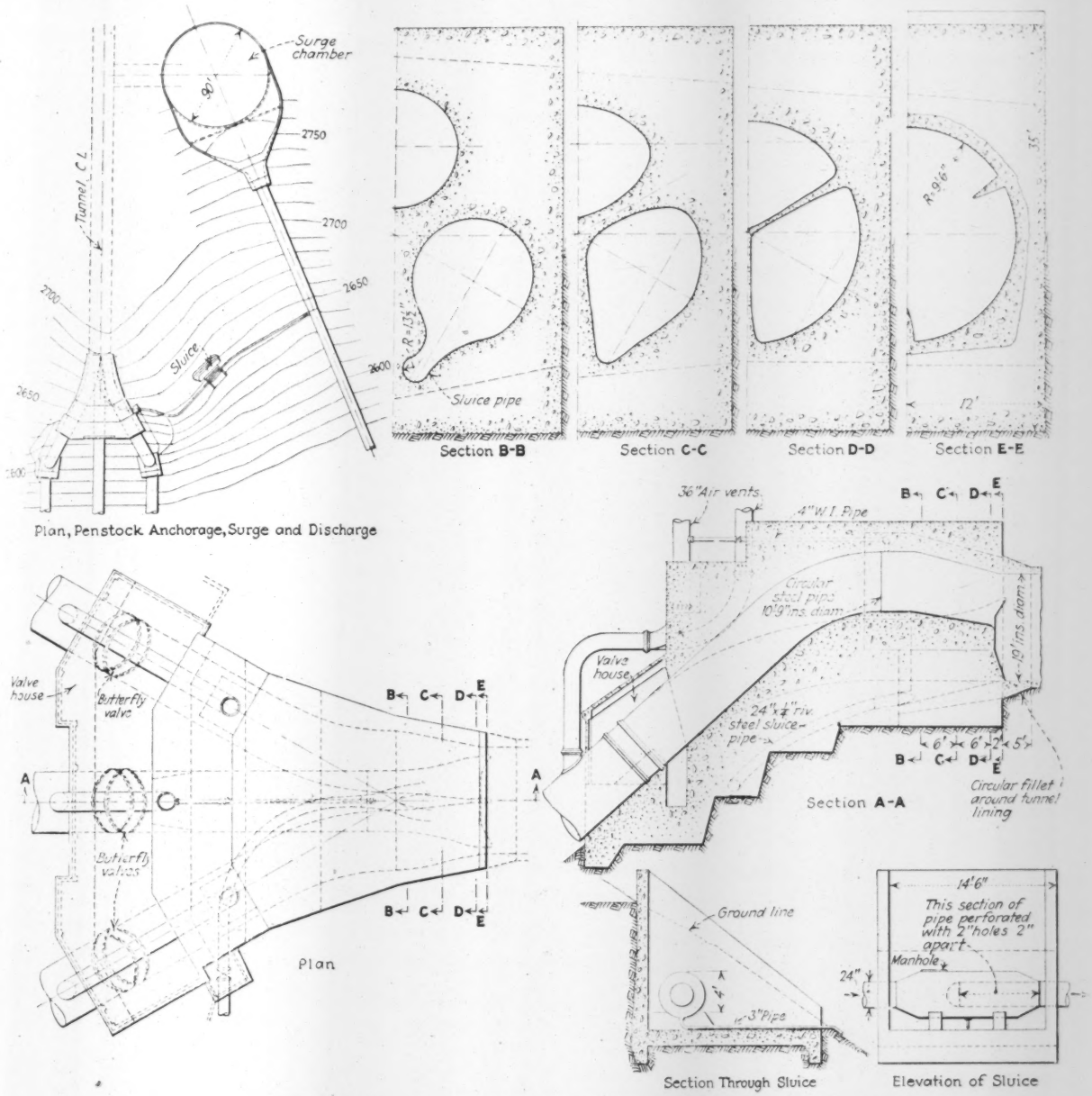
Tunnel Section Changed Smoothly to 3 Pipes in Concrete Block Which Also Affords Support for Air Vents

THE transition from a 19-ft. concrete-lined tunnel to three steel penstocks, 10 ft. 9 in. in diameter, was effected at the recently completed Pit 3 plant of the Pacific Gas & Electric Co. in California by means of a concrete anchorage which at the same time served as a support for the air vents and provided a convenient housing for the valve operating mechanism. Details are shown in the accompanying drawing.



PENSTOCKS, VALVE HOUSE AND AIR VENTS FROM POWER HOUSE

The transition from the tunnel is made in a length of



DETAILS OF TRANSITION FROM TUNNEL TO PENSTOCKS

23 ft. with the aid of three radial diaphragms ("fins") which meet at the center and then thicken in a smoothly changing shape until all three passageways become circular and connect with the steel penstocks.

The bends in the steel penstock were selected with the purpose of giving as easy a curve as possible without unduly increasing the yardage in the concrete anchorage. Concrete was poured after the steel penstock bends and the wood forms in the transition sections had been fitted into place, thus making the anchorage a monolithic structure around the steel and wood forms. All three penstocks were brought into the same plane on the surface of the slope below the valve house and in the two outer lines additional anchorages were provided where bends were required to make the three lines parallel.

A feature of the transition is the 24-in. blowoff pipe with its trap or screen midway between the anchorage and the surge spillway. This pipe was put in so that any debris or other foreign materials in the tunnel could be sluiced out before reaching the penstocks and the trap was provided so that any material thus removed could be inspected.

The trap consists merely of an enlargement in the 24-in. line from which the water passes out through a capped cylindrical screen of the type ordinarily used in screening rock. The sediment will lodge in this enlargement whence it can be removed through the manhole or sluiced out through the drainpipe at the bottom.

Design of these features was worked out by the Pacific Gas & Electric Co. engineering department; A. H. Markwart, vice-president in charge of engineering. The detail of the design was developed by Walter Dreyer and Clinton De Witt, assistant engineers.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

Binghamton, N. Y.

Broome County Courthouse

COUNTY SEAT OF BROOME COUNTY, N. Y. Lies at the confluence of Susquehanna and Chenango Rivers at elevation of over 800 ft. Has extensive manufacturing interests including boots and shoes, cameras and photographic supplies, leather goods, furniture, electrical apparatus, clothing, cotton fabrics and medicines. First settled in 1787 as Chenango Point, named Binghamton in 1800, incorporated as village in 1834 and as city in 1867. (Pop. est. 1924) 70,000.

LARGELY because of the city's irregular topography and its position with reference to the Chenango and Susquehanna Rivers, there have been imposed upon the city engineering department of Binghamton, N. Y., some difficult though clear cut problems. The city lies in the terminal moraine area. Three outstanding engineering features then become apparent. Earth roads are of natural gravel, the sewerage problem is a difficult one, and bridge repair maintenance is a chief responsibility of the engineering department of the city.

The city engineer (the present incumbent being Edward H. Prentice) is appointed by the mayor and holds office during a two-year term. His direct superior officer is the commissioner of public works, under which bureau the city engineer's office is organized. The city engineer has duties exceeding in general administrative weight that of his immediate chief. He is a member of the mayor's cabinet and also of both the Board of Estimate and Apportionment and the Board of Contracts and Supply. Through these bureaus he wields considerable influence in selection of engineering equipment for the maintenance of the city's engineering structures, and in the allocation of money for new structures.

Design and construction of all engineering works is under the direct charge of the city engineer. The maintenance of them is the responsibility of the commissioner of public works. At times that arrangement works a hardship, because certain works enter the maintenance stage at the very time of their completion and unless perfect harmony exists between the city engineer and the commissioner of public works, difficulties are liable to arise.

The city engineer is also superintendent of public buildings, bridges, docks, and wharves, and is assignable to smaller jobs by the commissioner of public works or the city council. It is apparent then that with the topography and geography such as it is, and with the multiplicity of duties outside of the strictly technical, the position is one requiring a wide range of ability.

The responsibilities which the engineer possesses and the resource which he must exercise are reflected in his office organization. The first of the city engineer's three assistants has as a special responsibility pavement design and construction, a second works almost exclusively on sewer work and a third on surveys. Each assistant engineer has his own field parties, and the whole force is supplemented during the construction season by from 10 to 12 inspectors. As there is no budgetary provision for the payment of inspectors, their salaries are charged against the jobs and their employment ceases when the job is finished. A new influence in engineering drafting offices and one which might quite well be given general vogue, judging from the atmosphere of the Binghamton city engineer's office, is the presence of a woman draftsman.

In the opinion of Mr. Prentice, there is real opportunity for constructive work by a city plan commission in the control of new real estate subdivisions. In Binghamton, for example, such subdivisions are usually laid out by ambitious real estate firms and sold to the public who build houses where they think their lots are or should be. After a number of houses have been built and the owners clamor for water and sewage facilities, as a matter of sanitation the city engineer sends out parties to make surveys for such installations. That is his first contact with conditions as they are. The Binghamton City Planning Commission has only advisory powers and no money. A city planning commission given power to make such subdivisions as are recorded on real estate maps conform to exact lot and block measurements and courses as well as a general agreeable plan as to street widths and contours, would do much toward facilitating these surveys by the city.

Binghamton really overlies an immense gravel bed. Therefore, there is less paving in the city than one would find in other cities of equal size. Of a total of 115 miles of streets, about 40 miles are gravel roads. These gravel roads are kept in repair by scarifying, rolling and treating with oil. After the street is shaped and rolled, heavy road oil—about ½ gal. per square yard—is applied and as many treatments as are considered necessary given. The property owners pay for all the road oiling, the cost amounting yearly to between $3 to $4 for a lot with a 50-ft. frontage. (This treatment of gravel roads is for outlying residential streets.)

In Binghamton Warrenite bitulithic is the favorite pavement being laid.

Like all the towns that line the Susquehanna and that use that river as a means of sewage disposal, Binghamton faces the ultimate necessity of yielding to the pressure of the State Board of Health. The city started to build an interceptor during the war, but the contractor ran into high material costs, an exceedingly high water period and difficult labor conditions and failed. The city then attempted to do something with the plans and equipment, but finally gave up. Disposal of sewage into the two rivers seems to have no particularly bad effect except what may be offensive slightly now and then to the eye or nose. There are numerous riffles in the river just above the city, so that by the time the water reaches the sewer outfalls, it carries a high oxygen content. That perhaps is one reason for the continuation of this means of disposal. Another is the fact that the two cities down the river both get their water supplies from wells.

Construction of new sewer services has given the

city engineer a great deal of worry. Two principal sewage-works extensions are under way. They have to do with the elimination of Trout Brook and the draining of Brandywine Swamp. In the first of these, the brook gushes from a ravine in a section of the city near the Chenango River. From a steep, short inception it spreads into a flat area about ½ mile or more in length, and several hundred feet wide. The controlling gradient in this area is 0.07 per cent. A combined system is impossible, because of the uncertain flow of the creek in the flat gradient. A sanitary sewer discharged directly into the Chenango River is impossible because with an 8-in. pipe carrying sewage from several hundred homes with some industrial waste, sewage would undoubtedly settle out in the pipe. The flat area has therefore been drained through the installation of a large concrete pipe discharging into the Chenango. A sanitary system that runs almost in an opposite direction for a short length takes the sewage to a sump, whence it is lifted 16 ft. to a trunk where gravity takes it to another point in the river. Draining Brandywine Swamp will perhaps be much the same sort of job, as this area is becoming populated rapidly. A study of its drainage is now under way.

The city of Binghamton has eight bridges to look after that cross either the Chenango or the Susquehanna. All of these, save one recently completed, have been built for some time, and in view of that fact a study has been made of them in the light of present-day traffic requirements. Some strengthening has been done, but particularly noteworthy is the work which is contemplated for the Exchange Street bridge. This is a steel truss structure of two 200-ft. spans. A study revealed a condition of comparative safety, but the factor of safety was not considered high enough. The present plan includes reinforcing of the top chords by side plates, installation of new gusset plates, and new diagonal members. A new decking of 4x6-in. timber will be laid flush, with the 4-in. faces exposed. Steel traffic plates are to be laid and the decking brought flush with the top of the traffic plates by a 2-in. bituminous mixture.

Binghamton is active in its provision for recreational facilities. George F. Johnson, the shoe manufacturer, has been greatly interested in park development for a number of years and has given considerable money to the city toward such development. This development work has resulted not only in the construction of certain recreational structures, but in the building up of an entente cordial between the city engineering department and a group of architects.

Sewage-Works with Effluent for Irrigation

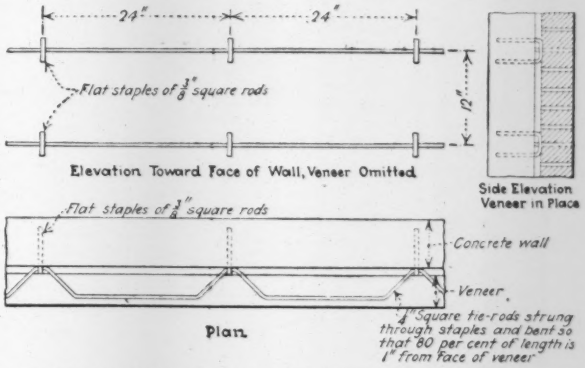
Sewage-works for Walla Walla, Wash., to produce an effluent to be used for irrigation, according to a report recently submitted by Pearse, Greeley & Hansen, Chicago, would include a 45-minute detention primary settling tank, 40,000 sq.ft. of sprinking filters, 8 ft. deep, secondary settling tanks with 45 minutes of detention, and a chlorination tank with a 30-minute contact period. Sludge would go to a digestion tank and drying beds. Works of 6-m.g.d. capacity for a present sewer-connected population of 20,000 would involve a gross annual cost of $22,080, including 7½ per cent capital charges on $207,600, which might be reduced to $16,680 by irrigation revenue.

Attaching Masonry Veneer to Concrete Walls

By Norman M. Stineman
Structural Engineer, Portland Cement Association, Winnetka, Ill.

THE problem of attaching unit masonry veneer to monolithic concrete walls is of particular importance in parts of the country likely to be subjected to tornadoes or earthquake shock. It is of equal importance when a veneered building is attacked by fire.

Monolithic reinforced concrete bearing-wall construction and reinforced concrete skeleton construction with panel walls of the same material are two of the several types of construction which have shown a high degree of resistance to earthquake shock, to the force of tornadoes and the attack of fire. Though the usual exterior finish for a structure of either type is portland cement stucco, when masonry veneering is desired for special reasons, it should be anchored securely to the concrete backing.


24"
24"
Flat staples of ⅜" square rods
12"
Elevation Toward Face of Wall, Veneer Omitted
Side Elevation Veneer in Place
Flat staples of ⅜" square rods
Concrete wall
Veneer
Plan
¼" Square tie-rods strung through staples and bent so that 80 per cent of length is 1" from face of veneer

DETAILS OF MASONRY VENEER AGAINST CONCRETE, SANTA BARBARA BUILDING CODE SPECIFICATION

The drawing here shown illustrates a simple method for attaching veneer of masonry units to concrete walls. This method is specified in the new building code of Santa Barbara, California. Flat staples are embedded in the concrete. The staples project just far enough to permit insertion of a ¼-in. tie-rod. This rod, bent as shown, is strung through the staples. The height of the staple is sufficient to permit vertical adjustment of the tie-rod so that it can be laid flat into the horizontal joint without being forced. Furthermore, the staples are set sufficiently close to the face of the concrete to prevent interference with the veneer units. The space between the face of the concrete wall and the back of the veneer will vary from ¾ in. to 1 in., and will as a matter of course be filled with mortar.

The Santa Barbara building code was written by Verne D. Hedden, a structural engineer of that city, following the earthquake of June, 1925.

Zoning Act in Virginia

The Standard Zoning Enabling Act drawn up by a committee backed by Secretary Hoover has been adopted in substance by the Virginia legislature after four years of struggle to pass a comprehensive zoning act. The Virginia legislation varies from the standard act in (1) providing for a board of zoning appeal of three members instead of five, appointed by a local court instead of by the city council, and (2) in including a provision that "nothing herein contained shall be construed as impairing any vested right."

Comparative Tests on Concrete Piles in Sea Water

Los Angeles Harbor Board Studies Four Different Types—Driven Piles Deflected 6 In.—Results Show Danger Attends Only Cracks Above Tide Level—Field and Laboratory Tests

TESTS have recently been completed at Los Angeles harbor on laboratory samples and on full-sized concrete piles supplied by four manufacturers who accepted a general invitation to participate in comparative tests of their products by the harbor commission. Nine kinds of tests were made of which the ninth was with full-sized piles driven in the harbor and the other eight were on laboratory samples of the same material. In addition to these tests a number of existing structures which had been in service for a dozen years or more were carefully examined and their condition studied in the light of what the tests showed. A voluminous report giving the results of the tests in detail, recently transmitted to the harbor commission by George F. Nicholson, chief engineer, concludes that concrete piles, by the time they are in place, generally have a large number of fine cracks but that only those cracks above tide level result in corrosion of the reinforcing steel. The following has been taken from the report.

The tests were suggested as a preliminary to the extension of the harbor department's construction program and have been under way since March, 1925. Previous reference to them appeared in *Engineering News-Record*, March 12, 1925, p. 446. The primary purpose was to make a practical comparison of the various types of piles offered for Los Angeles harbor structures with respect to (1) cost, (2) ability to support safely the necessary loads and (3) ability to withstand the forces of deterioration in actual service. The eight laboratory tests were (1) Density and absorption; (2) compression; (3) transverse bending; (4) value of E_c and n; (5) repeated load; (6) static load; (7) bond and (8) permeability.

Piles and samples were submitted by (1) The Pan-Pacific Construction Co., makers of "Duocrete" piles; (2) the Raymond Concrete Pile Co.; (3) W. A. Bechtel Construction Co., makers of the Conzelman pile, and (4) the Los Angeles Gement Gun Co., specializing in "gunite." The design of the piles is shown in Fig. 1.

Materials used in the preparation of test specimens varied considerably but in general were of excellent quality. The sands were well graded and contained a very low percentage of silt. The gravel was graded from 1-in. to ¼-in. sizes with small percentages between ¾ and 1 in. No gravel was used in the gunite samples. The cement was a good grade of domestic cement, passing the standard tests. Reinforcing bars, furnished by the harbor department, showed a yield point ranging from 33,000 to 44,000 lb. per sq.in. and an ultimate strength of 55,000 to 65,000 lb. per sq.in.

How Test Piles and Samples Were Made—(1) The mixes used by the Pan-Pacific Construction Co. were 1:3:3 (*A*) and 1:1.8:3.25 (*B*). The concrete was mixed so dry that there was no slump to the mixture. Forms were stripped after two days and samples were cured 30 days under wet burlap.

Impregnation of these samples with asphaltum was effected after the curing period by first placing them in a drying chamber where the temperature was held at 180 deg. F. for 16 hr., after which the heated concrete went into the treatment chamber. Here the samples were subjected to a vacuum at a temperature of 190 deg. F. and then liquid asphaltum at temperatures from 220 deg. to 280 deg. F. was introduced and maintained under a pressure of 120 lb. per sq.in. for 22 hr.

(2) The Raymond Concrete Pile Co. used a mix of 1:1.5:3 which gave an average slump of 5 in. for the entire set of samples. The samples were covered with wet sand when 24 hr. old and forms were stripped at the end of 8 days, after which all samples except the absorption and permeability blocks were covered with wet sand for an additional 30 days.

The absorption and permeability samples were coated with "Ironite" waterproofing for three successive days and on the fourth day were given a coat of neat cement. The waterproofing material for all four coats was cut with water so that it could be applied with a brush. After curing, all samples were stored in the open air until tested.

(3) The W. A. Bechtel Co., in making the Conzelman piles used a mix of 1:1.4:3.6 which showed a slump test of 1½ in. These piles consisted of concrete shells that were cast in advance and later filled with concrete. After a 10-day curing period the inner surface of the shell was painted with asphaltum just before the core was poured. Three 6-in. holes were left in the top of the shell (as it lay on its side) so that the concrete core could be poured and tamped properly. Great care was taken in this work and all concrete was tamped unusually well. Forms were stripped in two days and the specimens were cured for 30 days under wet burlap.

TABLE I—PERCENTAGE OF ABSORPTION

Sample	Specific Gravity	24 Hours	48 Hours	72 Hours	14 Days	Weight per Cu.Ft.
Duocrete *A*	2.45	0.3	0.3	0.3	0.3	153.1
Duocrete *B*	2.41	0.2	0.4	0.4	0.4	150.4
Raymond	2.42	1.59	1.77	1.96	2.21	151.2
Gunite	2.29	1.58	1.75	1.83	1.83	143.0
Conzelman	2.43	1.82	1.97	1.97	2.15	151.8

(4) The mix used in the Los Angeles Cement Gun Co. gunite was 1:3½:0, with a slump test of ½ in. No stone larger than ⅜ in. was used. Materials were expelled from the nozzle of the gun under an air pressure of 35 to 40 lb. per sq.in.

In building up both the samples and the piles themselves a backing of boards was used for the first half of the work, after which the samples were allowed to set for 24 hr. before the second half was blown. The piles were constructed in a vertical position where they were allowed to remain for a 30-day curing period during which time water was allowed to trickle over them. Samples were buried in wet sand for 30 days.

Laboratory Tests—Samples for the density and absorption tests were dried for 8 hr. at a temperature of 105 deg. C. before being immersed in water. The average results of these tests are given in Table I.

Conclusions on test results shown in Table I were that: (1) The concrete was very uniform, giving concordant results; (2) the absorption of the Duocrete was very low, due to the asphaltum coating; (3) the effect of well graded aggregates was noticeable in the untreated concrete. The Raymond samples although protected with "Ironite" showed a little higher per-

centage of absorption than either the Conzelman or gunite specimens. (4) The absorption in all of the samples was low.

The compression tests were made on 6x12-in. cylindrical samples and were carried out according to standard methods with the results shown in Table II.

Conclusions on test results shown in Table II were: (1) That the effect of consistency upon the ultimate strength is shown very clearly by a comparison of the Conzelman and Raymond tests. (2) The method used in building up the gunite piles and samples is equivalent to extra tamping and in conjunction with a richer mix produces increased density and strength. (3) In the Duocrete samples those in which the treatment had less penetration showed a higher compressive strength. Specimens made of a mix that left open connecting voids which were filled with asphalt under treatment showed a lower strength.

Transverse bending tests were made on specimens 14 in. square and 14 ft. long on supports 12 ft. apart with load applied at the center. These samples contained eight ½-in. square straight reinforcing rods with centers 2 in. from the faces, of which four were at the bottom, two at the top and one on each side halfway up. These specimens were not designed for beams but as a direct means of comparing bond values and as a check on the possible amount of bending which could be given before cracks would appear.

Two samples were tested to failure by steadily increasing loads, a third sample was loaded to 75 per cent of the load at which the other two showed signs of failure and this load was maintained for three days while observations were taken periodically. In order to better observe any signs of failure the sides of the samples were given a very thin brush coat of plaster-of-paris. This coating was just thick enough so that when dried it gave a white surface and aided in locating failure cracks. The average results of these tests are given in Table III.

Conclusions on test results shown in Table III were: (1) The specimens actually were cracked before any signs of failure were apparent to the naked eye. As reinforced-concrete piles are usually handled in a horl-

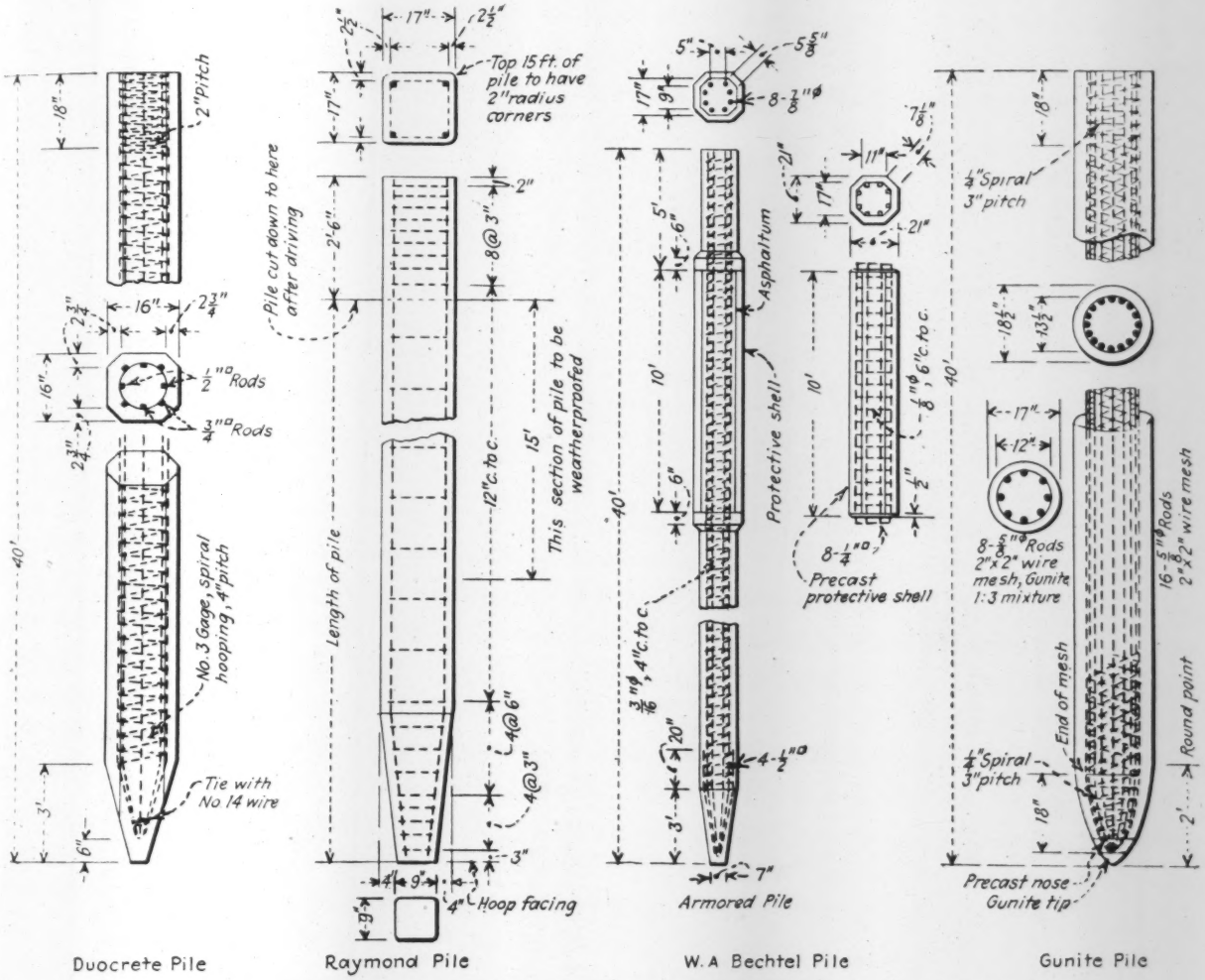


FIG. 1—DETAILS OF FOUR CONCRETE PILES TESTED BY LOS ANGELES HARBOR DEPARTMENT

TABLE II—RESULTS OF COMPRESSION TESTS

	Age, Days	Min., Lb. per Sq.In.	Max., Lb. per Sq.In.	Average, Lb. per Sq.In.
Duocrete A	63	3,260	5,260	4,080
Duocrete B	60	2,185	3,035	2,660
Raymond	65	1,840	3,475	2,585
Gunite	55	3,500	5,840	5,040
Conzelman	54	3,965	4,970	4,375

TABLE III—RESULTS OF TRANSVERSE BENDING TESTS

	Age, Days	Load at First Crack	Ultimate Load	Max. Deflection, In.	Deflection at First Crack	Total No. of Cracks
Duocrete *A*	39	10,905	19,010	1 11/16	1/4	10
Duocrete *B*	40	10,055	19,440	1 1/2	1/4	12.5
Raymond	39	13,430	21,405	1 5/8	1/4	18
Gunite	37	13,055	20,445	2 3/16	3/16	18.5
Conzelman	47	10,255	20,945	2 3/16	3/16	23

zontal position and as there is always deflection in excess of that noted in these tests, it may be assumed that such piles are generally cracked. (2) The untreated concrete showed more cracks than the Duocrete. The cracks in the untreated concrete were closer together and from this it was deduced that the bond between steel and concrete was better there than in Duocrete.

Modulus of elasticity tests were made on specimens 6 in. in diameter and 24 in. long. The deformation was measured over a length of 14 in. and the loads were added in increments of 100 lb. The lowest compressive strength recorded was more than 2,500 lb. while the average was more than 2,900 lb. per sq.in. From the results of these tests it was concluded that it would be safe in reinforced-concrete piles to use either 10 or 12 as the value of n (ratio of E_S to E_C).

The tests showed the untreated concrete to be very consistent while the concrete treated with asphalt was more or less erratic. From these and other tests it was concluded that while any of the concrete under test would be suitable for concrete piles, different designing factors should be used for the treated and untreated concrete.

The repeated load tests were made on 6x12-in. cylindrical samples. Loading was increased in increments of 500 lb. per sq.in. and each load was applied 20 times before an increase was made. These tests indicated an initial deformation and a permanent set in the treated concrete much higher than for untreated concrete. In the latter where there had been complete penetration by asphalt the strength was less, regardless of age, than in companion samples having only a small asphalt penetration.

Static load tests were made by loading two samples of each type of concrete to 35, 55 and 85 per cent of the ultimate strength as determined in the compression tests. These tests showed that failure could be expected when concrete was kept under a dead-load of 55 per cent of its ultimate strength for a considerable length of time. The Duocrete samples with the smaller penetration of asphalt showed better results than those having complete penetration.

From the bond tests using bars of various types it was concluded that (1) concrete made of high relative consistency gives high bond values. (2) Concrete made purely for compressive strength is lower in bond strength than when made wet. (3) To get high values for both bond and compressive strength the relative consistency of the concrete should be such as to give a slump test of from 1 to 2 in. (4) Very appreciable slippage occurs before the maximum bond value is reached. (5) Round deformed steel bars gave higher ultimate bond value than plain round, plain square or deformed square bars.

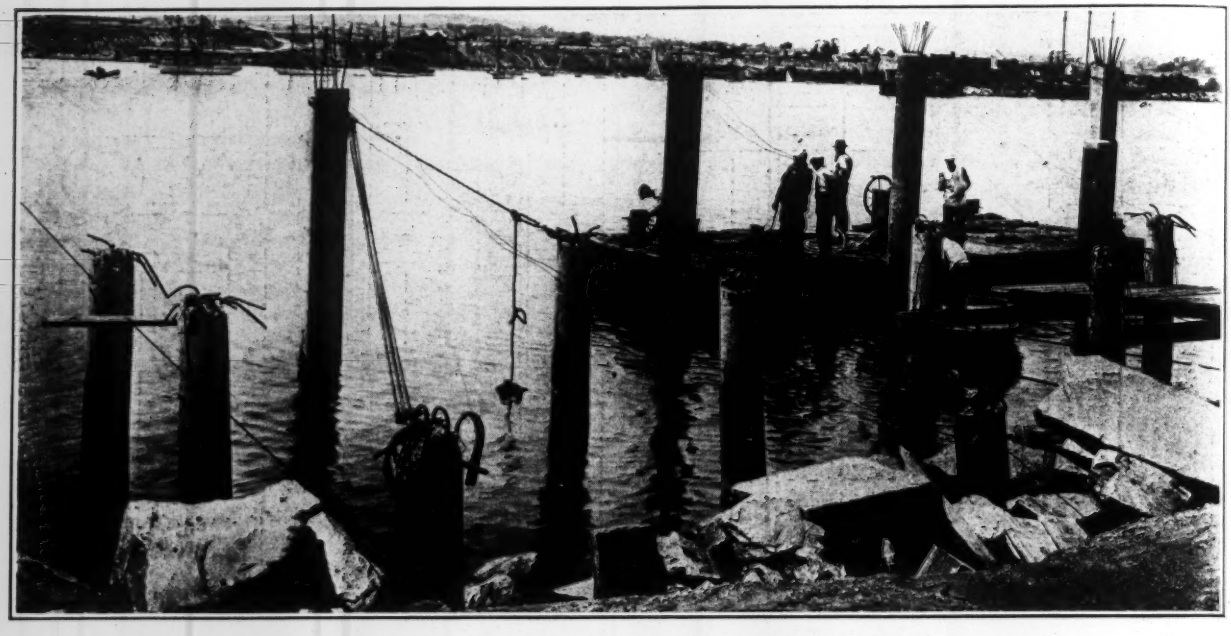


FIG. 2—PILES IN POSITION FOR 6-IN. DEFLECTION TEST

Permeability tests were made with six samples cast with wooden cores embedded in them, the cores later being drilled out so as to give a 1-in. hole leading to the center of the sample. Pressures up to 70 lb. per sq.in. were applied. All but two samples of both Duocrete *A* and *B* showed excessive leakage at all pressures. This was undoubtedly due to the dry mix used. Of the untreated Raymond and gunite concrete, two samples each would not leak at any pressure while the Conzelman samples showed low but consistent leakage. From these tests the report concludes, "that regardless of the density, concrete piles will be completely saturated within a few hours after being submerged."

Pile Driving and Pulling Tests—In these tests the piles were jetted down for the first 15 ft. and driven 3 ft. farther without jets. The hole caused by the jets

was allowed two weeks in which to fill and then half the piles were subjected to a side strain sufficient to pull the top of a pile 6 in. out of line. A diver was employed to observe the piles under test and he reported that Duocrete pile No. 1 (1:3:3 mix) and Raymond pile No. 1 (1:1.5:3 mix) were broken by the side strain during the bending. None of the other piles showed breaks large enough for the diver to observe.

All of the piles were inspected immediately after they were pulled and all were found to be cracked. Those deflected 6 in. out of line were cracked considerably more than those not subjected to this strain. The cracking in the deflected piles was from a point approximately 5 ft. below the mud line to about 6 ft. above. The cracks encircled the pile and were not confined to the tension face of any of the test piles. Chipping the concrete off down to the seal showed all these cracks to be over the hooping.

To supplement the tests with observations on older concrete an investigation of existing structures in the harbor was made. First an old pile, driven 12 or 13 years ago, was pulled for examination. This pile was cracked as badly as any of the test piles; from mean tide up the steel had rusted so badly that the concrete had spalled off, leaving the steel exposed for 6 to 10 in.; below mean low tide the concrete was as sound and the steel as bright as the day it was driven. Numerous large cracks and rock pockets occurred along the entire length of the pile and yet the steel was in perfect condition beneath them even in those cases where cracks crossed the steel.

These cracks were filled with clay at the surface and small white and brown crystals farther in. There was enough material in the cracks to prevent the flow of water through them, had there been any cause for such flow. An analysis made of the light colored material found in the cracks showed the following percentages: Calcium carbonate, 50; magnesium carbonate, 16; sodium chloride, 6; iron and alumina, 2; and insolubles, 11 per cent. Cracks occurring in concrete piles, it was concluded, will close themselves to such an extent as to eliminate danger of the pile failing through rusting of steel below low tide.

The results of the investigation indicated that a very large percentage if not all of the concrete piles made and driven are cracked. This was not interpreted to mean that the piles will not give good service or sustain their loads. The old pile pulled for examination had failed completely above mean tide and yet below low water was in excellent condition despite the fact that there were innumerable well defined old cracks in it. A number of concrete piles in the harbor were examined to check this conclusion and in every instance the concrete and steel were in good to perfect condition below mean tide, even in piles from which the concrete had spalled off to the depth of the steel above this level. This would indicate that there is little danger of failure due to steel corrosion below mean tide and that efforts to protect the steel should be centered on the portion above mean tide.

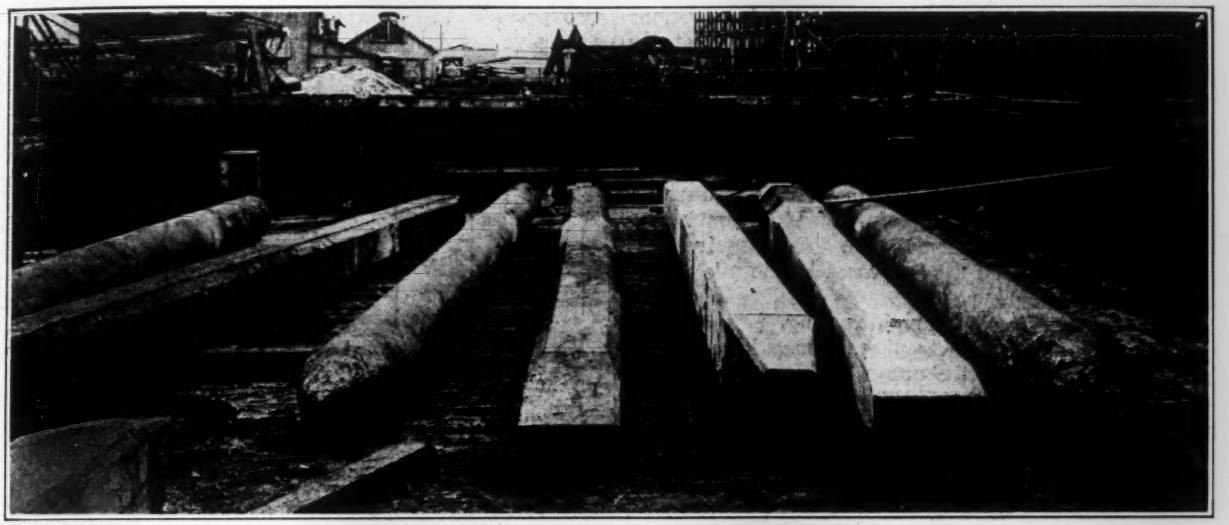


FIG. 3—PILES AFTER DRIVING AND PULLING TESTS

Below low tide there is no unbalanced pressure to cause displacement of the first water that enters cracks or pores and that water alone has not enough free oxygen to harm the steel, its continued presence, rather, protects the bars from further attacks.

Above low tide, on the other hand, gravity and evaporation are active but unless the cracks and pores are large, gravity is opposed and more or less nullified by capillary attraction, and evaporation alone gradually withdraws the water and makes room for a new charge of air or water whose oxygen renews the attack on the steel. On account of the semi-diurnal rise of the tide it is only near and above average high tide that evaporation has enough time to dry out a pile to the depth of the rods.

Conclusions—In a "summary of conclusions" the report states:

(1) It is difficult to handle concrete piles without cracking them.

(2) It is reasonable to assume that nearly if not all concrete piles in Los Angeles harbor are cracked more or less, the cracks encircling the pile at right angles to the line of applied loads.

(3) Small cracks below mean tide are not injurious to the life and usefulness of the pile.

(4) The endangered portion of the pile is above mean tide and efforts to protect it against deterioration should be concentrated upon that section.

(5) Any of the piles submitted for these tests are satisfactory for use in Los Angeles harbor, but the following factors should be considered in the adoption of any one of them:

(a) In the use of the Conzelman or gunite piles, a higher compression strength factor is justified than in any of the other types.

(b) The value of n for any of the types tested is a great deal lower than the value ordinarily used. This is especially true in the case of Conzelman and gunite piles.

(c) By using a semi-wet mix a maximum bond value is attained with a sacrifice of compressive strength; the ideal consistency for this type of construction is a compromise showing a slump of 1 to 2 in.

(6) Assuming a product equal to the samples tested, the choice of any of the types would be determined primarily by the cost and by the special conditions encountered—all the piles have outstanding features good for specific uses.

(7) In cases where the engineer feels that special precautions against cracking are desirable, the following expedients are suggested: (a) In handling the piles use a suitable "strong-back" to which the pile can be laced and use equalizing blocks in picking it up; (b) cracks due to handling can be minimized by manufacturing the piles in a vertical position. This requires less steel and gives lower initial stresses in the pile due to shrinking in the curing period.

(8) Since the steel, through rusting, is the prime cause of failure in concrete piles, it may be advisable to galvanize or copper the upper 10 ft. of reinforcing.

(9) Concrete below mean tide will last satisfactorily and by properly sealing or waterproofing the section of the pile above this level or by otherwise rendering the steel immune from rust, long life of the piles will result.

(10) In that section of piling above low-tide level dense concrete should be used to a thickness of not less than 2 in. over the steel. If asphaltum treatment is used, the relative consistency of the mix should be between 1.0 and 1.25 or such as to give a slump test of from 1 to 2 in.; treating temperatures should be kept low.

The tests were conducted under the general direction of G. F. Nicholson, harbor engineer, and under the general supervision of W. R. Sadler, chief chemist, harbor department, city of Los Angeles.

Climatological Data for United States

The reprinting of a large body of climatic data compiled by the Weather Bureau of the United States Department of Agriculture was completed late in 1925 and the data are now available to meteorologists and others both in complete sets and in separate sections. For the purpose of this work, which was begun in 1909 and which now contains data to 1923 for some sections and to 1920 for all, the United States is divided into 106 sections, with three additional sections concerned with Alaska and one for Hawaii. The complete work in its assembled form is known as Bulletin W of the Weather Bureau and comprises three volumes, which may be consulted in meteorological libraries. The separate sections are supplied, while the supply lasts, to individuals and business firms. The separate sections supply information regarding the climate and particularly the precipitation of each section.

Light I-Beams Developed for Joist Floor Construction

Beams of One-Third Weight of Standard I-Beams Produced in Sizes From 6 to 12 In. on New Mill

A RADICAL departure from established practice in the production of rolled steel shapes is announced by Jones & Laughlin Steel Corporation, Pittsburgh. The company has developed and is now producing commercially a series of very light I-beams, one-third the weight of standard beams of the same depth. Their production is the result of a growing demand for structural members adaptable to use in joist-type floors, in which light-weight composite sections, such as the well-known metal lumber (I-beams formed by welding two pressed-steel channels back to back), have found extensive use in recent years. The new beams, which

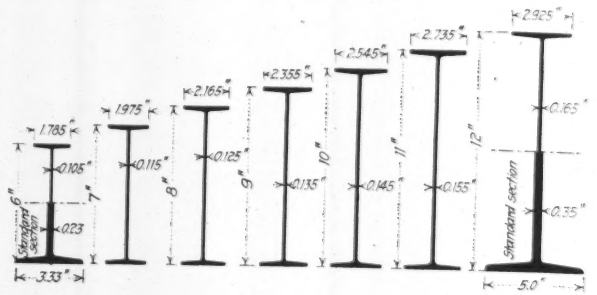


FIG. 1—JONES & LAUGHLIN "JUNIOR" I-BEAM SECTIONS

have been given the name "J & L Junior," are being produced in sizes ranging from 6 to 12-in. depth, by inches, as shown in the sketch Fig. 1. Their principal dimensions and properties are as follows:

Depth, In.	Flange Width, In.	Web Thickness, In.	Fillet Radius, In.	Area, Sq.In.	Weight, Lb. per Ft.	Moment of Inertia In.^{4}	Section Modulus, In.^{3}
12	2.925	0.165	0.240	3.14	10.73	64.02	10.67
11	2.735	0.155	0.225	2.74	9.37	47.42	8.62
10	2.545	0.145	0.210	2.37	8.11	34.24	6.85
9	2.355	0.135	0.195	2.03	6.93	23.99	5.33
8	2.165	0.125	0.180	1.71	5.84	16.20	4.05
7	1.975	0.115	0.165	1.42	4.85	10.45	2.99
6	1.785	0.105	0.150	1.15	3.94	6.36	2.12

For equal depth, the new beams have about the same efficiency in bending per pound of weight as standard beams, due to the practically uniform reduction of metal thickness in web and flanges. The striking advantage offered by the new sections, on the other hand, will be seen from the fact that for a given weight, say 9½ lb. per lineal foot, the new sections have a great advantage in strength and a still greater advantage in stiffness over the standard sections, the 11-in. beam of the new type being of about the same weight as a 5-in. standard I-beam but having double the bending strength and about four times the stiffness of beams of standard shape.

Design and production of the new beams followed several years' investigation and research by the company to develop light-weight structural shapes for floor joists. In such construction the joists are spaced relatively close—2 to 2½ in. apart—and carry a thin floor slab of concrete on a sheet of mesh fabric which serves both as reinforcement and as centering. With 2-in. floor slab and (below the beams) a hard plaster ceiling on metal lath, a floor of total deadweight not exceeding

40 to 50 lb. per square foot may be built, with sufficient strength for all but the heaviest occupancies, and a high degree of fire resistance. For such construction the standard rolled shapes are not economically applicable, as their thickness and bending-moment capacity require a larger joist spacing for economy, or else the use of shallow beams, giving a floor of insufficient rigidity. The company's experiments in the direction of developing suitable structural members of this service included members made of formed strip steel, and expanded rolled sections. The present solid rolled section is the result.

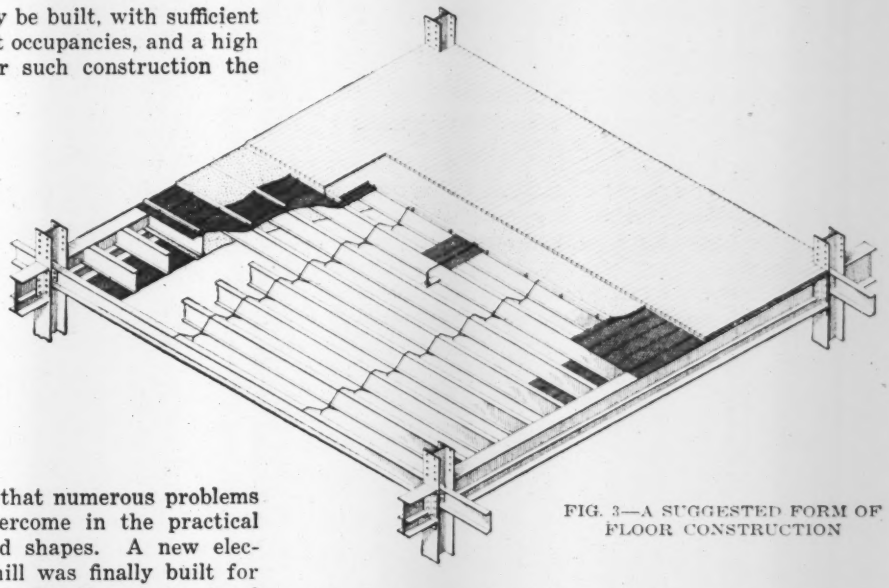


FIG. 3—A SUGGESTED FORM OF FLOOR CONSTRUCTION

It is stated by the company that numerous problems were met and successfully overcome in the practical production of these thin rolled shapes. A new electrically driven 14-in. rolling mill was finally built for their regular production. Steel of ordinary structural grade meeting current structural steel specifications is rolled, and very uniform strength properties are said to be obtained. An extensive series of special tests has been made on the new shapes by Prof. Milo S. Ketchum, of the University of Illinois, the results of which are to be made public in a short time and are expected to give definite values of the resistance of the several sizes of beams to various forces.

A complete series of end fittings and details has been developed for use with these beams. It is contemplated

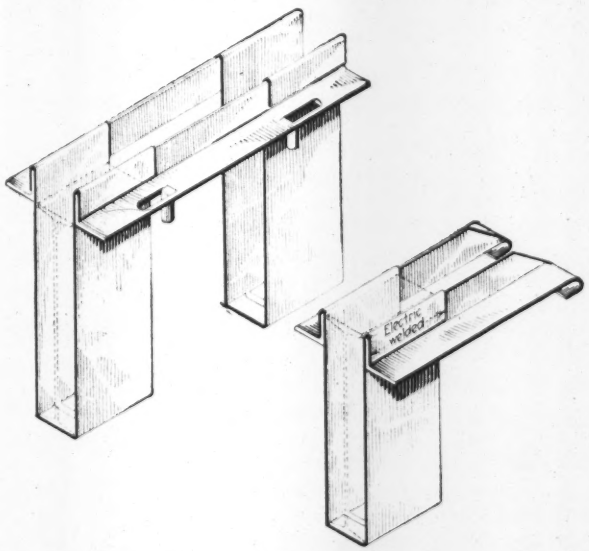


FIG. 2—HANGERS FOR USE WITH NEW LIGHT BEAMS

that in general the beams will be furnished cut to finished length, and will be supported by stirrups or hangers hung over the girder flange, thus requiring no punching or riveting. They may also be set on top of the girder or on a shelf angle riveted to the girder web. Hangers specially developed for use with the light beams, sketched in Fig. 2, are now being regularly produced by the company. In the typical floor construction, Fig. 3, a shelf-angle support for the joists is shown, this being an alternative method of construction.

Effective forms of bridging and attachment clips for steel fabric have also been worked out, together with tools for applying them. The attachment is made by pressed steel or wire clips, clinched by a special clinching tool.

Floors of the type shown develop surprisingly high load capacities. Thus, using 9-in. "Junior" beams spaced 24 in., the safe load capacity on an 18-ft. span is 88 lb. per sq.ft. (at working stress 16,000, or 99 lb. at working stress 18,000). Deducting a dead-load of 40 lb. per square foot, this would leave a live-load capacity of about 50 lb. per sq.ft. The 12-in. section, on the same spacing and span, would be able to carry a safe load of 175 lb. per sq.ft., or a dead-load of 40 lb. and a live-load of 135 lb., which exceeds the loading usually specified for light industrial occupancy.

Jarvis' Study of Flood Flow Extended

In an extension of his study of extreme floods and flow formulas (American Society of Civil Engineers *Proceedings*, December, 1924), C. S. Jarvis, in *Public Roads* of February, 1926, presents a calculation of maximum floods for five streams, checked (after the calculation was made) by unpublished flood data in the possession of others. In each case a close check on the rate of maximum flood flow was obtained. This gives further support to the flow formula which Mr. Jarvis advocates: $Q = p\ 10{,}000\ \sqrt{M}$, where Q represents the maximum flow in second-feet, M the drainage area in square miles, and p is that fraction of the maximum flow possible in any region that occurs in the particular region or on the particular stream under discussion. The values of p adopted for the five streams were estimated from known flood flows of nearby streams of quite different drainage area, and ranged from 0.10 to 0.48. The percentage value of this fraction has been found to be roughly equal to the average annual runoff depth (in inches) from the drainage area. The article includes a map giving values of the fraction for many streams and regions of the United States.

Two Additional Reports Made on Rapid Transit at New York

Suburban Passenger Transit Commission and Westchester County Transit Commission Submit Their Final Reports

TWO reports on rapid transit in the metropolitan district of New York have been published recently; one by the New York State Suburban Passenger Transit Commission to the state Legislature summarizing its work, and the other a final report by the Westchester County Transit Commission to the board of supervisors of the county.

New York State Commission Report—The report of the New York State Suburban Passenger Transit Commission reviews seven of the plans submitted for handling suburban traffic in and out of New York, those of the Westchester County Transit Commission, the North Jersey Transit Commission, the New York State Transit Commission, the Eisinger plan, the Turner plan, the New York, Westchester & Boston R.R. plan (Miller plan), and the West Side plan. It proposes no plan for the solution of the suburban transit situation; rather, the report is a summary of the existing propositions with very little comment upon them. The commission states in its conclusions that a comprehensive solution of the problem cannot be arrived at by a legislative committee, and therefore recommends to the Legislature that the whole matter be referred to the Public Service Department of the state for the development of a plan. (The state Legislature adjourned without acting upon this recommendation.)

Westchester Plan—The final report of the Westchester County Transit Commission to the Board of Supervisors of Westchester County is the fifth of a series of reports by the commission on the transit situation in that county including both rapid transit facilities between the county and New York City and bus and street-car traffic within the county. The portion of the report which is of more than local interest is the plan for providing additional rapid transit facilities for the suburban traffic from the county to the business district of Manhattan Island. This plan is sometimes called the Brinckerhoff plan, because it is an enlargement of a plan prepared by Henry M. Brinckerhoff, the present engineer of the commission, in 1920. The plan, in general, calls for running the electric suburban trains of the Putnam and Harlem divisions of the New York Central, of the New York, Westchester & Boston, and the New Haven railroads through a deep level tunnel from the neighborhood of 149th St. down under Madison Ave. and connecting streets to the city hall, with stations at 125th St., in the Grand Central region, and near the city hall. Possible connections with a New Jersey transit system and to Long Island are suggested, but are considered as beyond the scope of the Westchester commission's report.

The report outlines and comments upon practically the same plans as are reported upon by the New York State Suburban Transit Commission, except that it adds some comments on a plan prepared by William J. Wilgus and one by Harold M. Lewis, both for the Regional Plan of New York and Environs. It makes no comment upon the Eisinger plan, a scheme somewhat similar to the Brinckerhoff plan with New Jersey and Long Island connections, except indirectly, in stating that the commission considers the construction of a general transfer station in the 149th St. neighborhood—an important feature of the Eisinger plan—to be impracticable.

The commission's engineer recommends as the first step the construction of a two-track subway over the projected route to be followed by the construction of two additional tracks from 149th St. to the Murray Hill loop. The estimated cost of this work is put at $95,000,000 and $140,000,000 respectively. Construction is to be financed by the issue of bonds guaranteed by Westchester County, the interest upon which is to be paid by an increase of 10c. per trip in the present suburban fares.

Mr. Brinckerhoff also calls attention to the possibility of integrating this plan with that of the North Jersey Transit Commission. Extension of the Westchester line from City Hall under the Hudson River to the Jersey Central Terminal and thence to the Meadows Transfer would form the south and east side of the "interstate loop," while the extension of the present Queensboro tube, now ending at 8th Ave., west under the Hudson River to New Durham and thence south to the Meadows Transfer would form the north and west sides of this loop. Attention also is called to the possibility of extending the present 14th St. eastern line of the B. M. T. across under the Hudson River to the Meadows Transfer and also a possible extension from the Jersey Central Terminal south through Bayonne to Staten Island, and from the city hall terminal of the Westchester line across to Flatbush Ave. terminal in Brooklyn, to supply traffic for the empty-car movement northward up Manhattan Island in the Westchester tubes. With reference to the movement of New Jersey passengers in Manhattan Island, the engineer's report calls attention to the fact that the B.-M. T. Broadway line was built with four tracks in anticipation of its being extended northward up 8th Ave. and that the present 8th Ave. subway now under construction leaves this excess capacity available as part of a New Jersey loop.

The commission recommends to the county supervisors that steps be taken to carry on the work of the Westchester Transit Commission and to negotiate with the city of New York and the railroad companies in order to decide upon actual contract terms under which the commission's plan may be put into operation.

Inland Waterway Traffic at Bremen Increases

Traffic on the canals and rivers of the Bremen consular district showed a marked increase in 1925, according to consular advices to the United States Department of Commerce from Bremen, Germany. The number of ships and barges that passed through the Bremen locks bound upward and downward in 1925 was 7,344 compared with 4,916 in 1924. Cargo carried was 1,755,000 tons in 1925, as against 1,208,000 tons in 1924. Of the shipments coming to Bremen from the interior in 1925, over 700,000 tons were of coal. The completion in 1924 of a section of the Mittellandkanal to Hannover, which now forms a connecting waterway from the Rhine-Westphalian-Ruhr district to Bremen, and will soon extend to the Elbe, is held to be largely responsible for the increase. General conditions were reported to be unfavorable for barge-owners during 1925, in spite of the increased cargo carried. Freight rates were low because of severe competition. Unfavorable conditions of the water-level also affected river and canal navigation.

Notes on the Construction of the Kentucky University Stadium

Construction of Self-Contained Sections Allows Maximum Re-use of Forms and Erection of Structure as Finances Permit

By D. V. Terrell
Professor of Civil Engineering, University of Kentucky, Lexington, Ky.

CHIEF among the features of the University of Kentucky stadium, part of which has recently been built, was the construction by sections wherein maximum re-use of forms was made possible.

The structure was designed in U-shape with bowed sides. This type employs the advantages of the bowl and the U-shape with straight sides and avoids the disadvantages of those two types except that of excessive cost. In the Kentucky stadium excessive cost was avoided by using the chords of the curve as seat lines. This allowed the appearance and benefits of the bowed sides to be retained and at the same time permitted the use of straight lines in the layout of the seat banks.

The more the sides were bowed, the nearer to the playing field the end sections would be, thus tending to equalize the seat values. The problem was to bring the end sections as near to the playing field as practicable without forcing the side sections too far away from the playing field. By experiment it was determined that the outside radius of the six end sections (Fig. 1) should be 188 ft. and that of the side sections 1,184 ft.

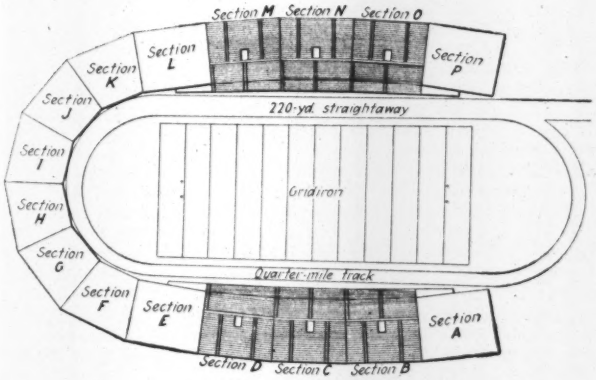


FIG. 1—GENERAL PLAN OF KENTUCKY STADIUM
Hatched sections show part of stadium now built

To facilitate architectural treatment, the columns around the back were equally spaced. It was found that a spacing of 18 ft. 3 in., center to center of columns, with five bents to a section, worked out well from a structural standpoint and gave the required seating capacity to the stadium. Each section was designed as a separate unit and is complete within itself. There is a ¾-in. expansion joint between sections, or every 86.25 ft.

The forms were built in section units so that they could be used in the construction of several different sections. At first it was thought that two complete sections of the forms would be sufficient, but later it was decided to build three complete sections. Accordingly form lumber was used twice in the construction of the six sections. The forms were made entirely of wood. Column forms were of 2-in. lumber and the decking forms of ⅞-in. lumber. Supporting timbers were 6 x6-in. pieces. The wall forms were made in sections and used six times. Special care was used in fitting, wiring and bracing the forms with the result that there are in this structure very few sags or bulges. The contractor used 350,000 ft. b.m. of lumber which had about 30 per cent salvage value when the work was completed.

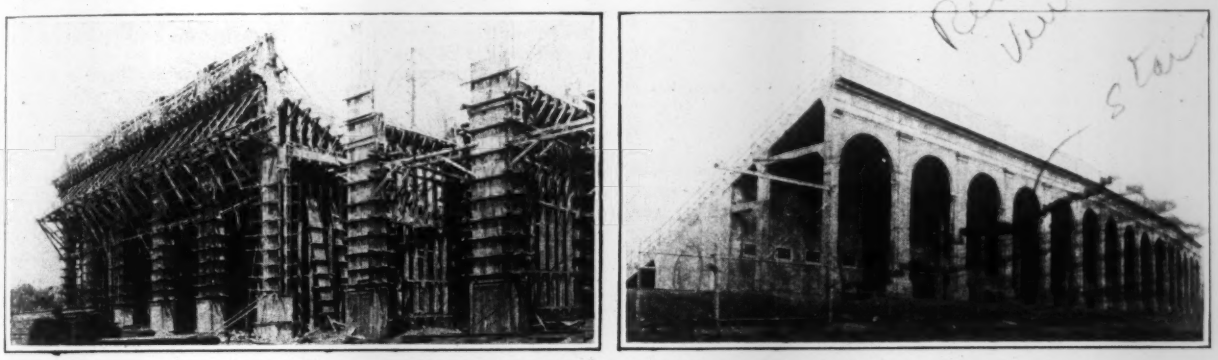


FIG. 2—EFFECT OF USING CURVE CHORDS AS SEAT LINES
Figure at left shows a portion under construction, indicating the comparative ease on straight-line form building. At the right is the same section completed.

As is seen from an accompanying figure, but six of the sixteen sections which will compose the finished stadium have so far been built. It is now possible to build one section at a time as funds become available. However, it would seem advisable not to add to the present six sections until funds are available for four more. This would complete the sides lines and provide a total of 17,000 seats.

In the stands there are thirty-two rows of seats. The height of the risers is 9 in. for the first eight, 10 in. for the next eight, 11 in. for the next eight and 12 in. for the last eight. This gives excellent visibility from all seats. The treads are 26 in. wide.

The contract was completed without the charge of a single item of extra expense and at a cost of $116,520. Of this $12,500 can be charged to the new field and $6,500 to the facilities under the stands so the seat cost therefore is $9.37.

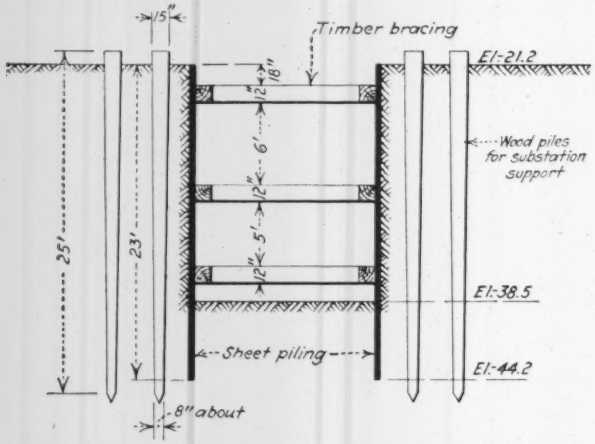
Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Thrust Pressure Induced by Pile Driving

Sir—There has been a question raised recently in regard to the thrust produced on cofferdam bracing from driving piles adjacent to it. I have not been able to find any information relative to this and I thought that perhaps the question could be answered by some of your readers.

The accompanying sketch shows the arrangement of a steel sheet cofferdam and adjacent wood piling for a substation substructure which we are constructing. The sketch



COFFERDAM SHEETPILING AND ADJACENT WOOD PILES

shows the wood supporting piles on either side of the trench for the suction tunnel.

In detail, the problem is this: Steel sheetpiling is in place and the entire trench has been excavated. The soil into which the supporting piles are to be driven is composed of soft blue clay and glacial silt for the entire length of the pile. All elevations given are below city datum which is approximately 3 ft. above mean lake level. In driving the piles, the initial penetration with just the weight of the hammer is about 10 ft. and we have specified that piles shall be driven until the penetration per blow shall be ¼ in. or less, using a 3,000-lb. steam hammer with 3-ft. drop.

This procedure, of course, exerts quite a lateral force on the cofferdam bracing and the question I am mainly concerned with is to find at just what point along the pile this force may be considered or whether it would be uniform for the full length.

GEORGE N. SMITH,
Senior Assistant Engineer, Department of Public Utilities, Division of Water.

Cleveland, Ohio,
April 2, 1926.

Real Costs of Municipally-Owned Railway Cannot Be Ascertained

Sir—I have read with interest the editorial in your issue of April 15, p. 597, "Charging Properly for Public Money," particularly the last sentence, where you state that San Francisco has to maintain a true accounting system, although grudgingly, for its municipally-owned street railways.

While it is a statutory requirement that the accounts of the municipal railroad be properly kept, it is, nevertheless, impossible to get a true statement of the operations of this municipal monstrosity called a railroad. I am not referring now to the actual physical operation but to the idea and to the management. The San Francisco charter requires that the accounts of a public utility be kept as if they were private institutions. There have been many attempts made by interested citizens to obtain a statement from the municipality in regard to the true earnings of the municipal railway, but to date they have been unsuccessful.

The accounts are so juggled that it is impossible to tell whether or not the road is actually a paying investment or whether it has a deficit. The employees of the road are just now asking for an addition to their pay. The receipts of the road, as divided up, do not show that this increase of pay can be made without creating a deficit. It is therefore proposed to reduce the depreciation fund from 18 to 3 per cent and take this difference of 15 per cent of the receipts and throw it into the employees' wage fund. It is a question whether this will provide for the raise asked by the employees and it is proposed to ask the voters to authorize a bond issue of $2,000,000, the major portion of which is to be used in paying running expenses.

It is supposed that privately-owned street railroad companies which laid the original paving will repair the pavements traversed by the car lines for a space between and 2 ft. outside the tracks. On the municipal line, however, this obligation for original paving is shunted off to the abutting property owners, while the street repairs are charged to general street repair accounts. As no public record is kept of this work as it is done, either by private property owners or by the city, no charge appears on the books of the municipal railroad.

Another important matter connected with these municipally-operated projects is the constant urging upon the city officials (who are susceptible to bloc voting) by the employees working as a unit for increased remuneration. An example of this can be shown by the action of our city government when the Municipal Railroad Department took over what is known as the Union St. line. The working hours were immediately reduced from 9 to 8 and the wages raised 20 per cent; the superintendent's salary was doubled and he was given an assistant at the same rate as he was formerly receiving as superintendent. The secretary was treated in a similarly liberal manner, although the amount of work the superintendent and secretary had to do was in reality decreased. The rate of fare on the cars, however, remained the same. As the privately-owned line was just about breaking even, you can readily see where the municipal line came out on the operation of this particular piece of road.

W.

San Francisco, Calif.; April 22, 1926.

Engineering Salaries

Sir—In the issue of Mar. 18, p. 460, I noticed a discussion by P. L. Brockway and William E. Wickenden on the subject of salaries paid to engineers. In this, Mr. Brockway suggests that perhaps the lower paid men do not answer questionnaires, thus giving an apparent average rate of pay higher than actual.

While this may, and probably does have some bearing, I think that another, and much more potent question is being overlooked by both parties. That is, what proportion of an engineer's time is he unemployed owing to seasonal character of work and how often does his work cause him to move? In comparing engineers with other professional men such as doctors, lawyers, etc., having about the same amount of training, this must be taken into account.

A representative of *Engineering News-Record* told me once that the average number of changes of address were about five per year. My own have been about two and a half. Each move costs from $100 to $300, not counting the higher cost of living in places you are not well acquainted with. If a man is working out of headquarters for a large organization, on construction work he either has to move in for about three months, sometimes at a reduced salary, or lay off, picking up what he can usually at a smaller salary than he makes at his regular work.

For this reason a man who reports his salary at $1,800 to $2,400 is really only being paid on a par with the men in other lines whose salaries run from $1,300 to $1,800—also bearing in mind the fact that it is practically impossible under these conditions to really make a home of the sort that most people want.

A. O. BOSSHARD,
Bureau of Materials, State Division of Highways.

Springfield, Ill.,
March 29, 1926.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Building Officials Discuss Better Construction

Columbus Meeting Gives Attention to Improved Field Inspection—Old Buildings Safeguarded

Sixty municipalities were represented by one or more delegates at the twelfth annual meeting of Building Officials' Conference, held at Columbus, Ohio, on April 27 to 30. With representatives of several building industries the total attendance was about 150.

Technical details of quality and use of building materials, and method of construction, preponderated in the reports and papers presented. Unfortunately their number and length precluded adequate discussion. Such discussion as was offered seemed to indicate a greater desire on the part of the officials for help and information in the matter of the administration of statutory or extra-legal requirements.

Inspection at Owners Expense

A point that found repeated expression in the discussion was the insufficient equipment and inadequate personnel in the offices or bodies that are called upon to administer the laws relating to the construction of buildings. In this connection, the paper on Inspection of Structures at Owner's Expense by Edward C. Kerth, civil engineer, former commissioner of buildings of Evansville, Ind., was of especial significance. Mr. Kerth urges the enactment of suitable legislation requiring the owner or other person contemplating the erection of a building other than a small dwelling house, to employ at his own expense a competent engineer-inspector, who has been duly approved and registered by the building official, to assume full responsibility for the safe construction of the building and compliance with the law. To those who questioned the legal possibility of such legislation, Mr. Kerth replied that he had been advised by competent legal talent that the plan is feasible and constitutional.

Lack of Inspection

The deficiency in public building inspection again became prominent in the discussion of the paper entitled Building Code Requirements as to Loads and Unit Stresses by Prof. Clyde T. Morris, Ohio State University. It was pointed out that the safety of a structure is dependent as much on workmanship as on sufficiency of design. The latter can be readily determined by an examination of the plans before the issuance of a permit, whereas no municipality can afford to employ a large enough force of inspectors to make sure that the structure is properly assembled.

In a paper on The Design of Buildings to Resist Earthquakes, H. R. Kingsley, engineer of the Hollow Building Tile Association, again stressed the importance of workmanship. Mr. Kingsley, who drew largely on his personal experiences in the great Japanese earthquake, while expressing the view that all the usual types of construction, if properly designed and carefully erected, could be made safe, dealt largely with the use of terra cotta in buildings designed to resist earthquakes.

The Fire Resistance of Clay Hollow Load Bearing Wall Tile by H. D. Foster, research associate at the U. S. Bureau of Standards, was like the preceding paper one of a group presented at a joint session with the Hollow Building Tile Association. It described the experiments being conducted on hollow-tile walls to determine not only their fire resistance but also their strength and other characteristics.

In a very thoroughgoing paper, Safeguarding Old Buildings Against Fire, Edwin M. Lurie, civil engineer of the Associated Metal Lath Manufacturers' Association, discussed the perplexing question of what to do with old buildings probably constructed in accordance with the laws and standards of a former day but affording inadequate protection against the greater fire hazard of today.

Other papers presented at the several sessions included Developing Co-operation between Building Departments and Structural Material Producers, by Albert E. Kleinert, superintend-

(*Concluded on p. 744*)

Engineering Fifty Years Ago

From *Engineering News*, May, 1876

Railroads in Iowa

AS OUR readers all know, a large amount of grading and bridging was done several years ago on the railroad which was being built under the name of the Iowa Northern R.R., to connect Keokuk and Cedar Rapids by way of Washington and Iowa City. The company however failed to prosecute the work for want of funds, and for some time the undertaking has been regarded as defunct. There is a prospect however that this work may yet be completed. The road from St. Louis to Keokuk on the west side of the Mississippi is now almost finished, and that company are now making propositions to extend their road into Iowa on the old track of the Iowa Northern. We have every reason to believe that at no distant day this gap will be filled.

General Water Power Survey Actively Opposed

American Engineering Council Opposed to Survey as Unnecessary Expenditure of Funds

An estimate of the cost of making surveys of the available water-power sites throughout the country was transmitted to Congress on April 26 by Maj. Gen. Harry Taylor, Chief of Engineers, and O. C. Merrill, executive secretary of the Federal Power Commission. This report was authorized by the last Congress.

The report divides the country up into main watersheds or groups of small watersheds and gives individual estimates of the cost of surveys for the larger streams and for the smaller streams by groups of watersheds. The total cost of making all the surveys is estimated at $7,322,400.

These surveys in the opinion of American Engineering Council, "are unnecessary and would constitute an unwise expenditure of public funds."

L. W. Wallace, the executive secretary of American Engineering Council, in discussing the matter before the Rivers and Harbors Committee of the House of Representatives, declared that the fundamental data on water supply and topography as now being collected by the Geological Survey is sufficiently complete to serve the needs of all interested. He pointed out that a comprehensive program of topographical surveys has been authorized by Congress and that a similar authorization for a water resource inventory is pending. "If Congress will make regularly the appropriations these regulations contemplate" Mr. Wallace declared, "all the data required for water power development will be assembled with sufficient rapidity to meet all needs. To collect these data through any other than the accepted agencies now doing the work would result in duplication."

The point also was made to the committee "that while official surveys of this character are being made it had been the practice of the government to prevent the development of the power demanded by the consuming public until the completion of the survey work."

Board to Study Water Power Possibilities of Ottawa River

The provinces of Quebec and Ontario have decided to establish a joint engineering board to investigate the power possibilities of the Ottawa River, including the proposed development at Carillon. There are numerous water falls on the Ottawa River, located on the inter-provincial boundary line, concerning which it is felt that a better delimitation of the respective rights of each province is necessary.

WASHINGTON NOTES

A BOARD of engineers soon is to be appointed to make a study of the practicability of the spillway as a means of reducing flood heights on the lower Mississippi river. Among those being considered for membership on this board are Maj. Howard S. Bennion and Maj. John C. Gotwals of the Corps of Engineers.

There long has been a demand in New Orleans and throughout the territory below Red River for some form of protection to supplement the levees. Spillway advocates never have been able to impress the Mississippi River Commission with their theories. This has led to the charge that the commission has come to the conclusion that outlets cannot be used to advantage. In ordering a complete study of the matter the intent of Congress to have the survey made by the Corps of Engineers was set forth clearly. For that reason no member of the Mississippi River Commission will be asked to serve on this board.

The Chief of Engineers is very anxious to conduct this survey so that the report will have weight with the people principally concerned.

THE report of the Joint Engineering Board which is engaged in the St. Lawrence study cannot be made until June. It had been hoped that a report could be made in April, but more work is involved in figuring the estimates than had been anticipated. In addition, it was found desirable to make borings at Messina and at Iroquois.

Long Viaduct Under Construction at Baltimore

An 816-foot viaduct, with width of 55 ft., is being constructed by the municipal government of Baltimore, Md., as part of the city's program for the elimination of grade crossings.

The new viaduct will do away with the grade crossings at Smith Ave. and North Ave., on the Northern Central division of the Pennsylvania R.R. In order to do this it was necessary to plan a structure that would span the wide stretch of low-lying land between the railroad tracks and Falls Road. For this purpose the city's engineering department determined upon a structural-steel viaduct encased in concrete, with reinforced concrete slab to carry the roadways, and reinforced overhanging footways. The roadway will measure 40 ft. between curbs, with electric car tracks in the center. The two footways will each be 6 ft. in width. Trolley and lighting poles will be set into the parapet walls. The span over the railroad tracks will measure 68 ft. 4 in., and a span of the same length will cross Jones Falls. Fifteen other spans are included, with length varying from 41 ft. 2 in. to 43 ft. 2 in.

The contract was let to J. L. Robinson in January; work now is well under way. The total cost is estimated at $250,000, of which the Pennsylvania Railroad will contribute $50,000.

Further Study of Mount Hope Toll Bridge Project

Authorization of a $6,000,000 state bond issue for construction of the Mount Hope toll bridge between the island and mainland of Rhode Island failed of enactment in the closing hours of the state legislature's session, last week. The bill passed the senate but died in the house committee, the main objection to it being that its inclusion in a state referendum would jeopardize the passage of other bond issues, totaling about $8,000,000, which are needed for regular purposes. It was feared that the difference between the bridge appropriation with its toll amortization feature and the other bond issues might not be clearly understood by the voters, with the result of endangering the approval of the bond issues.

With a view to promoting the toll bridge project, however, the legislature passed a resolution directing the state board of public roads to make further traffic and construction studies as a basis for subsequent financial estimates, "to the end that as soon as possible a proposal may be submitted to the people for a bond issue to cover this project." D. O. Cargill is bridge engineer of the board of public roads.

Villages Given More Power in New York State

A number of additional powers relating to public works and services have been granted to the villages of New York State by amendments to the village law embodied in a bill signed by the Governor. Among these are the right to collect and dispose of garbage, ashes and rubbish without authorization by popular vote, and removal of former restriction confining these powers to villages of 10,000 population or more. With the restrictions noted the law already gave villages the alternative of letting contracts for this work, including disposal by burning, or of doing the work themselves.

Other grants of powers to villages are: Acquisition of land for any municipal purpose by either condemnation or purchase; right of any incorporated village (instead of a limited few) to adopt a sanitary code, with a new provision that the code may be either the standard plumbing code of the New York State Department of Health or one locally formulated; and the right to assess upon abutting property the cost of water main extensions, payable by installments if the water commissioners so decide.

John Hays Hammond Honored on His 71st Birthday

Friends of John Hays Hammond, prominent mining engineer, gave a dinner in honor of his 71st birthday at the Waldorf-Astoria in New York City on May 3. Many men, leaders in the varied fields into which Mr. Hammond's activities have taken him, were present at the dinner; others from all parts of the world sent their greetings by cable or telegram.

Record Capacity in High-Head Impulse Turbines

The Southern California Edison Co. recently placed orders for two 56,000-hp. impulse turbines to operate under an effective head of 2,200 ft. The static head will be 2,420 ft. These units will be used to drive 50-cycle generators at a speed of 250 r.p.m. Provision is to be made for changing to 60-cycle operation in which case the speed will be increased to 300 r.p.m.

These units will be the first to be installed in the new Big Creek No. 2-A plant, the ultimate capacity of which is to be 300,000 hp. The water supply will be taken from Shaver Lake through the recently completed Shaver Lake tunnel. The ultimate storage capacity of Shaver Lake is to be increased to 210,000 acre-ft. according to present plans which include the Huntington-Pitman-Shaver tunnel, now under construction, that will bring in a supply from Huntington Lake.

These hydraulic turbines will exceed the present world's capacity record by 16,000 hp., it is said, this record being claimed for the two 40,000-hp. impulse turbines in the Serra plant of Sao Paulo Tramway Light & Power Co. of Sao Paulo, Brazil. Of the two units for the Edison Co.'s 2-A plant order has been placed for one with the Allis-Chalmers Manufacturing Co. of Milwaukee and for the other with the Pelton Water Wheel Co. of San Francisco.

Plan Start of Cuban Highway in August

The Cuban Cabinet expects to advertise for bids on the Central Highway in the near future and to award contracts during the month of August. Surveys of 900 km. of the 1,099 km. which will make up the Central Highway have been completed by the Cuban Department of Public Works. The government expects to complete the work in from 4 to 5 years, but in case the revenues obtained under the public works fund will not be sufficient to pay for the work done annually, the payments are to be spread over the entire 10-year period in which the taxes for the fund are in effect. It is not expected, however, that a definite decision will be made in regard to the methods of payment until some later date as two methods are now under consideration.

Seismological Society Forms Eastern Section

Active steps are being taken to develop an Eastern Section of the Seismological Society of America. Membership in the section is graded into full membership (annual dues $4, including cost of membership in the society itself), and associate membership (annual dues $1; does not involve membership in the society). Officers of the section pending permanent organization are: Chairman, Dr. James B. Macelwane, St. Louis University, St. Louis, Mo.; Ernest A. Hodgson, Dominion Observatory, Ottawa, Canada; secretary-treasurer, Commander N. H. Heck, U. S. Coast & Geodetic Survey, Washington.

Illinois Central Runs Electric Train at Chicago

In preparation for the opening of electric traffic on the Chicago interurban lines of the Illinois Central R.R., a trial run with a six-car train was made on April 27. It is expected to begin regular electric service in July on the entire suburban system, as described in *Engineering News-Record* of Feb. 25, p. 322.

Bridge Season Rates Established

A yearly toll scheme for automobiles on the St. Johns River bridge at Jacksonville has just been established under order of the Circuit Court. Season-tickets will be sold at $30, but for 1926 the rate will be $17.50. A metal tag attached to the front of the automobile will allow the car and passengers to pass without paying tolls. The tags will not be good for trucks, trailers, buses and taxicabs. Frank Brown, clerk of the Board of County Commissioners, plans to put the tags on sale on June 1.

Federal Waterways Operate at Loss During 1925

The annual report of the Inland Waterways Corporation shows a loss of $65,214.01 for the year of 1925, exclusive of interest charges on the $11,548,278.59 invested. The Corporation owned by the United States to "promote, encourage, and develop waterways, and to foster and preserve in full vigor, both rail and water transportation," operates the federal water transportation systems on the Mississippi and Warrior Rivers. The total tonnage transported on the two divisions amounted to 1,142,129 tons, an increase of 70,371 tons over 1924. Revenues of the corporation from the Mississippi -Warrior service amounted to $4,010,096.43 while the total expenses were $4,044,615.82.

N. Y. Water Power Commission Acts on Two Applications

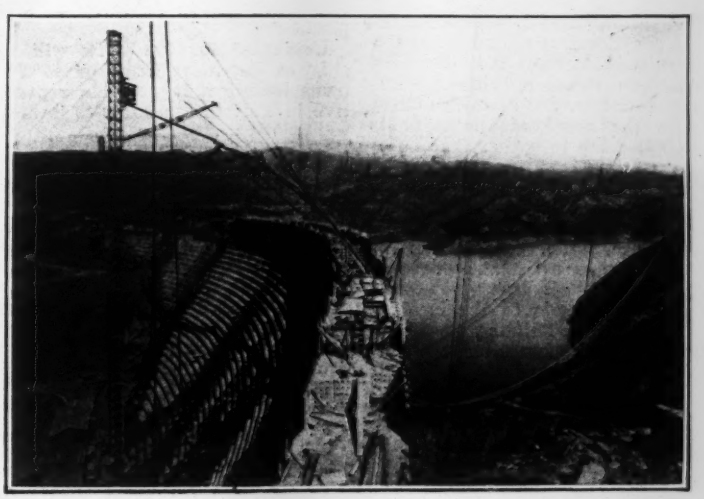
The New York State Water Power Commission, on April 28, granted an amended preliminary permit to the Lower Niagara River Power & Water Supply Co. which will enable it to make an investigation of the use for power development purposes of 19,725 sec.ft. in the lower Niagara River Gorge.

The commission has announced that it will hold a hearing on the application of the American Super-Power Corporation for a preliminary permit covering a two-stage development in the international section of the St. Lawrence River. The upper development is to be located at the lower end of Ogden Island near Morrisburg, Ont., and the lower development is to be at the foot of Barnhart Island, near the town of Massena, N. Y. This application is in conflict with that of the St. Lawrence Valley Power Corporation whose application was heard by the commission recently.

War Department Funds Alloted For River and Harbor Work

The Secretary of War has approved the allotments recommended by the Chief of Engineers for authorized river and harbor works contained in the $50,000,000 War Department appropriation bill, approved April 15, 1926. Those amounting to more than $100,000 are as follows:

Allegheny River, Pa.—Lock and dam construction	$1,000,000
Aransas Pass — Corpus Christi Channel, Tex.	410,000
Baltimore Harbor and Channels, Md.	300,000
Bay Ridge and Red Hook Channels, N. Y.	300,000
Black Rock Channel and Tonawanda Harbor, N. Y.	143,000
Boston Harbor, Mass.	115,000
Buffalo Harbor, N. Y.	118,000
Buttermilk Channel, N. Y.	200,000
Cape Fear River, N. C., at and below Wilmington	175,000
Chicago Harbor, Ill.	125,000
Columbia and Lower Williamette Rivers below Vancouver, Wash., and Portland, Ore.	300,000
Coos Bay, Ore.	545,000
Delaware River, Pa., N. J. and Del.—Philadelphia to the sea.	2,500,000
East River, N. Y.	2,000,000
Frankfort Harbor, Mich.	174,000
Galveston Harbor, Tex.	200,000
Galveston Channel, Tex.	245,000
Galveston Harbor-Texas City Channel, Tex.	200,000
Grays Harbor and Bar Entrance, Wash.	185,000
Hilo Harbor, Hawaii	390,000
Honolulu Harbor, Hawaii	150,000
Houston Ship Channel, Tex.	450,000
Hudson River Channel, N. Y.	150,000
Humboldt Harbor and Bay, Cal.	500,000
Inland Waterway, Delaware River to Chesapeake Bay, Del. and Md.	275,000
Inland Waterway, Norfolk, Va.-Beaufort Inlet, N. C.	420,000
Keweenaw Waterway, Mich.	140,000
Los Angeles Harbor, Cal.	900,000
Louisiana - Texas Intracoastal Waterway (New Orleans-Sabine River section)	1,200,000
Louisiana - Texas Intracoastal Waterway (Sabine River-Galveston Bay section)	800,000
Marquette Bay Harbor of Refuge, Mich.	112,000
Miami Harbor (Biscayne Bay), Fla.	600,000
Milwaukee Harbor, Wis.	726,000
Mississippi River, between Ohio and Missouri Rivers	3,000,000
Mississippi River, between Missouri River and Minneapolis, Minn.	2,250,000
Missouri River, Kansas City to the mouth	2,000,000
Mobile Harbor, Ala.	330,000
Monongahela River, Pa. and W. Va.	500,000
Muskegon Harbor, Mich.	140,000
Nawiliwili Harbor, Hawaii	180,000
New Haven Harbor, Conn.	157,000
New York Harbor, N. Y.	515,000
New York Harbor, N. Y.—Supervision	175,000
New York and New Jersey Channels	1,500,000
Newark Bay, Hackensack and Passaic Rivers, N. J.	600,000
Norfolk Harbor, Va.	290,000
Northern and Northwestern Lakes—Survey	145,000
Oakland Harbor, Cal.	275,000
Ohio River, lock and dam construction	9,000,000
Ohio River, open channel improvement	250,000
Port Aransas, Tex.	270,000
Providence River and Harbor, R. I.	100,000
Sabine-Neches Waterway, Tex.	920,000
Saco River, Me.	100,000
St. Johns River, Fla., Jacksonville to the ocean	450,000
San Francisco Harbor, Cal.	160,000
San Juan Harbor, P. R.	250,000
San Pablo Bay and Mare Island Strait, Cal.	325,000
Savannah Harbor, Ga.	550,000
Southwest Pass, Mississippi River	350,000
Tennessee River, Tenn., Ala. and Ky.—Survey	115,800
Tillamook Bay and Bar, Ore.	135,000
Wilmington Harbor, Del.	200,000
Wrangell Narrows, Alaska	175,000



ST. FRANCIS DAM ADDED TO LOS ANGELES WATER SYSTEM

THE city of Los Angeles has just completed the St. Francis dam in San Francisquito canyon, between the aqueduct hydro plants No. 1 and No. 2, with a reservoir capacity of 38,000 acre-ft. Storage in this location will make it possible to use water through power house No. 1 without passing it along to lower reservoirs. It will also be in a position to catch any water that might come down the natural stream bed as the result of any break in the aqueduct. Previous mention of the structure appeared in *Engineering News-record*, March 19, 1925, p. 497. The new dam is 650 ft. long and contains 175,000 cu.yd. of concrete. The maximum height is 205 ft., including a depth of 30 ft. below stream bed; the base thickness is 169 ft. It has a gravity section arched on a 500-ft. radius.

Oppose Trucks in Competition With Railroads

A protest by the Trade Council of Benton, Ill., has been made to the Governor against an effort being made to secure a permit from the Illinois Commerce Commission to operate a fleet of trucks over the state highways in competition with the railroads. The resolution points out that the railroads have spent millions of dollars in equipment, that they employ thousands of workers and have built up a transportation system that is efficient, but "it is an evident fact that the proposed truck lines would reduce the work of trained crews and cause a decrease in the consumption of coal by the railroads which are heavy and constant users of coal, thereby reducing the working time of the coal miners in this state, as the railroads use about 5½ per cent of all coal mined in Illinois."

Building Officials Discuss Better Construction

(*Concluded from p. 741*)

ent of buildings, Brooklyn; The Structural Factor in Fire Prevention, by S. H. Ingberg, physicist, U. S. Bureau of Standards; the Early Strength of Walls Laid in Lime Mortar, by J. S. Elwell, engineer of the National Lime Association; and The Ventilation of Dwellings and Garages, by A. L. Ferguson, Philadelphia.

The recommendations of the committees on hollow building units, on lime and on stucco as to acceptable practice in the application of these materials, were received and adopted. Some apprehension being expressed as to an official's attitude toward these recommended practices, the organization adopted a resolution to the effect, in part, that no member "shall be regarded as bound by the same in official actions in the administration of his office, it being the intention that rules of practice approved or adopted by Building Officials' Conference shall be regarded as a general expression of opinion of what may be considered good and acceptable practice to be amended whenever desirable to suit local conditions."

A report was made to the meeting by H. E. Plummer, building inspector, Portland, Ore., supplemented by committee secretary Horner of the Pacific Coast Building Officials' Conference, on the attempt now under way to formulate a uniform building code for all the cities of the Pacific Coast states.

New committees were appointed to formulate standards of practice in the use of wall boards, and steel joists, and on the administration of zoning ordinances. The chairman of these committees are respectively, Edward C. Kerth, Evansville, Ind., Wm. C. Muehlstein, Madison, Wis., and George Hauser, Cincinnati.

The following officers were elected for the coming year: president, H. E. Plummer, building inspector, Portland, Ore.; vice-president, W. C. Muehlstein, building engineer, Industrial Commission, Madison, Wis.; secretary, J. F. Downey, commissioner of buildings, Cambridge, Mass.

Builder of Collapsed Grandstand Guilty of Manslaughter

In connection with the fatal grandstand crash at Pasadena, Cal., on New Year's Day, noted in *Engineering News-Record*, Jan. 7, 1926, p. 35 and Jan. 28, 1926, p. 174, Paul F. Mahoney, contractor, was found guilty of manslaughter and has been sentenced to prison for from one to ten years.

Propeller Type Runners for Power Plant in Montana

Announcement has been made by the Montana Power Co. that work began April 1 on the construction of the Black Eagle power plant on the Missouri River near Great Falls, Mont., which will replace the old 8,000-hp. plant built in 1890 at this site. The new power house will be 50x140 ft. in plan and will house three propeller type runners operating under a head of 25 ft. and developing a total of 25,000 hp. for the plant. The new plant is to be completed by the middle of next year.

Work on 287-Mile Highway in Japan to Start Soon

The budget of Taiwan (Japan) for the year beginning April 1, 1926, contains an item of $6,000,000 for the construction of a highway 287 miles long, which will include the construction of 21 large and 510 small bridges, also 1,140 viaducts and culverts, according to the U. S. Department of Commerce. The first part of the construction program is to be spread over a period of ten years. The work will require an additional period to carry it to completion.

Contracts for the work will be let only to Japanese firms or to foreign firms having a responsible representative in Taiwan amenable to laws there.

Two New Piers to Cost $2,000,000 Approved for San Francisco

Two new piers to be built on San Francisco Bay by the California State Board of Harbor Commissioners were approved April 26 by the Governor and the state board of control. One of the piers, to be located near Fishermen's Wharf in the north part of the waterfront will be 1,200 ft. long and 385 ft. wide. This pier is to have a car ferry slip at the outer end and railroad tracks down the center. The other pier, well toward the southern part of the developed waterfront, will be 600 ft. long for the present with a design suitable for later extension to 1,200 ft.

Both piers will be of the standard concrete construction used in waterfront improvement made by the board unless the alternative of a solid fill for the northern pier should be approved by the War Department and finally adopted by the board. The estimated cost of the two new piers totals about $2,000,000, of which $1,700,000 is available in the state treasury and when additional funds are needed, there is still available some $7,000,000 worth of unsold harbor improvement bonds.

RANDOM LINES

Commerce!

Regarding the drawbridge closing controversy which the more sedate editorial columns some pages farther west have been discussing, the best statement of the case against the War Department we've seen was in a recent New York *World* editorial:

"Uncle Sam has 'sot' ways of thinking. A man and a boy on a brick-sloop leisurely threading the meadows are to him Commerce, whereas a thousand commuters chafing at the bit are merely a lot of people going somewhere."

* * *

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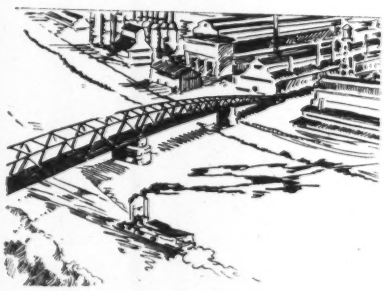


Additions to the Collection of Artists' Bridges

* * *

Licensed Engineers

Florida Designing Engineer to Draftsman:

"Look up this property and find the lot and block numbers."

F. D. E. (later):

"Did you find the lot and block numbers?"

Draftsman:

"No, sir, there are no lot and block numbers shown, but I found that the property was sub-divided by metes and bounds and . . . etc."

F. D. E.:

"Where do these people have their office?"

Draftsman:

"What people?"

F. D. E.:

"Metes and Bounds."

Engineering Societies

Calendar

Annual Meetings

NATIONAL FIRE PROTECTION ASSOCIATION, Boston, Mass.; Annual Meeting, Atlantic City, N. J., May 10-13, 1926.

CONFERENCE OF STATE SANITARY ENGINEERS, Washington, D. C.; Annual Meeting, Buffalo, N. Y., June 5 and 7, 1926.

AMERICAN WATER WORKS ASSOCIATION, New York City; Annual Meeting, Buffalo, N. Y., June 7-11, 1926.

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Convention, Philadelphia, Pa., June 13-19, 1926.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, State University of Iowa, Iowa City, June 16-18, 1926.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J.; June 21-25, 1926.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, N. Y.; Summer Meeting, Seattle, Wash., July 14-16; Annual Convention, Philadelphia, Pa., October 4-9, 1926.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Providence, R. I., Sept. 14-17, 1926.

INTERNATIONAL CITY MANAGERS' ASSOCIATION, Lawrence, Kansas; Annual Convention, Colorado Springs, Colo., Sept. 21-23, 1926.

The American Society of Heating and Ventilating Engineers will hold its semi-annual meeting in Lexington, Ky., May 26 to 28.

The American Society of Agricultural Engineers will hold its annual meeting June 23 to 26 at Lake Tahoe, Calif.; the discussions will be on reclamation, farm structures, farm power and machinery, and agricultural engineering research; and beginning June 28 there will be four days of inspection trips including inspection of hydro-electric and irrigation projects. Further information about the meeting may be secured from Prof. L. J. Fletcher, secretary of the Pacific Coast Section, University Farm, Davis, Calif.

Personal Notes

HENRY T. DYSLAND, architect, has opened an engineering and architectural office in Madison, Wis.

CHARLES I. CORP, professor of hydraulic engineering, University of Wisconsin, has been elected secretary of the Engineering Society of Wisconsin. LEONARD S. SMITH, professor of city planning and highway engineering, University of Wisconsin, who was secretary of the state society for thirteen years and aided in the development of its membership, resigned recently.

W. F. REICHARDT, has been appointed city engineer of Watertown, Wis., to succeed ARNOLD KRAEFT.

E. G. HEWSON, Toronto, Ont., has been appointed engineer of maintenance-of-way of the Canadian National Rys.; he was formerly president of the Engineers' Club of Toronto.

J. LEROY UNDERHILL, who has been engaged as a civil engineer with the Vermont Department of Highways, has resigned to become associated with the Vermont Lighting Corporation.

W. F. MILLER, division engineer of the Maryland division of the Pennsylvania R.R., has been promoted to engineer of maintenance-of-way of the Eastern Pennsylvania division.

Capt. EDWARD N. CHISOLM, JR., Corps of Engineers, who has been attached to the St. Louis office of the Mississippi River Commission, has been transferred to the Philippine Islands. He will be succeeded by Capt. HARRY EDMOND of Fort Humphreys, Va.

Prof. C. S. BROWN, of Nashville, Tenn., B. S. CAVINA, Memphis, W. H. SEARS, Chattanooga, and A. L. DABNEY, Memphis, have been appointed members of the board of architectural and engineering examiners of the state of Tennessee.

HUGH J. PENDERGAST, who has been supervising engineer on the construction of the Blue River and Gooseneck sewer projects at Kansas City, Mo., has been appointed deputy city engineer of Kansas City, to succeed A. D. LUDLOW. Mr. Pendergast will be assistant to Robert W. Waddell, city engineer, Kansas City.

FRANK H. MACY has opened an office at Rochester, N. Y., for consulting practice in hydraulic engineering. From 1910 to 1924 Mr. Macy was an assistant engineer on water power, storage and drainage matters for the New York State Conservation Commission, Water Supply Commission, and the office of the State Engineer and Surveyor. When he resigned from state service in 1924 he was chief of the Bureau of Water Power and Stream Control. In 1924 he organized with CHARLES CURRY of Dansville, N. Y., the firm of Curry & Macy, Inc., engineers and contractors.

Capt. HERBERT C. WHITEHURST, Corps of Engineers, until now on duty as assistant to the district engineer on the Wilson dam at Muscle Shoals, has been appointed assistant engineer commissioner of the District of Columbia, succeeding Major RAYMOND A. WHEELER who will be relieved from duty June 15 to go to Leavenworth, Kan., for training. Captain Whitehurst is a graduate of the Virginia Polytechnic Institute. He was appointed captain of engineers in 1917 and served with the 308th Engineers and with the 81st Division in France. After the War he returned for a time to the architectural and engineering firm of which he had previously been a member, but was re-commissioned captain of engineers in 1920 and in 1923, after service at Fort Humphreys, became assistant district engineer at Wilson dam.

JOHN P. HOGAN, consulting engineer, New York City, has become a member of the firm of Parsons, Klapp, Brinkerhoff & Douglas, engineers, New York City.

G. R. MILES has resigned as city engineer of Olean, N. Y., effective May 15, and the city is seeking a successor.

MAJOR S. C. GODFREY, Corps of Engineers, upon completion of the course at the General Service School of the Army at Fort Leavenworth, will become district engineer of the Mississippi River Dredging District with headquarters at Memphis. His previous service was in the Boston District.

JOHN C. BRIGHAM, formerly city engineer of Summit, N. J., and recently superintendent of public works of the borough of Mountain Lakes, N. J., has been appointed engineer-manager of Pleasantville, N. Y., with the title of village engineer. Mr. Brigham is a graduate of Cornell University. For a number of years previous to his work in Summit he was engaged in aqueduct and subway construction work for the city of New York.

BREHON B. SOMERVELL, major, Corps of Engineers, has been appointed division engineer of the Northeast Division of the Washington, D. C., district, succeeding MAJOR JAMES A. O'CONNOR, effective August 14, who will then report at the Army War College for duty as a student officer. As district engineer at Washington, Major Somervell will have charge of the project for increasing the water supply of the city of Washington, and other engineering works in the city and vicinity. Major Somervell served for a time during the War in the 89th Division and received the Distinguished Service Cross for bridge repair service in the action near Pouilly, France. He graduated from West Point in 1914 and since his return from France served at Fort Leavenworth, Kan., in New York City, and since 1925 in a course in instruction at the Army War College, where he is now stationed.

Obituary

JOHN W. CORNELL, Philadelphia, Pa., president of J. S. Cornell & Son, one of the oldest building construction firms in the city, died April 26, aged 60 years. The firm was founded in 1857.

Mrs. MINNA N. DENNES, member of the engineering firm of L. Copleston, Inc., Flushing, Long Island, New York, died April 11, at the age of 56 years, having served the company 22 years and, by studying engineering works, gained and held for many years a place in the company's estimating department, finally becoming an expert in estimating construction costs and being admitted to membership in the firm.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Knot-Hole Plugs Improve Grade of Lumber

A threaded "knot-hole plug" which promises an appreciable saving in waste is now being experimented with by the Ewauna Box Co. of Klamath Falls, Ore. A small piece of waste lumber is threaded by a machine and the knot hole in a low grade piece of lumber is also threaded out to the proper diameter. Following this, the plug is automatically screwed into the revamped knot hole, thus making a substantial piece of lumber from the former low-grade piece.

New Service Feature Added by Equipment Distributor

The service wagon shown herewith is a recent innovation of Edward Ehrbar, Inc., a large Brooklyn firm specializing in the renting and selling of air compressors, concrete mixers, hoists, pumps and steam hammers. The

inside of the truck is equipped as a repair shop and the equipment with the spare parts carried represents an investment of some $5,000. The auxiliary service rendered by this truck goes with all the equipment rented or purchased from the firm.

Use and Care of Wire Rope

The Marion Steam Shovel Co. suggests the following: Store in a place protected from the weather and any acid fumes. It is advisable to coat at least the outside of the core with a good lubricant.

Do not uncoil like a hemp rope. Roll like a steel hoop allowing the rope to lie straight on the ground.

Proper lubrication of a wire rope is as essential as is the oiling of an engine. As a rope bends over sheaves and drum there is necessarily a rubbing together of the internal wires. Thus it can be seen that correct wire rope lubrication does not mean simply covering the rope with any kind of oil or grease. A proper lubricant must work in between the wires and to the center core.

A new rope should be run for a while without a load so as to enable the rope to get "set" to the working conditions. Heating of course should be carefully avoided.

Careful cleaning from time to time will prolong the life of the rope. This may be done by using waste soaked in a medium oil.

Bending stresses set up when wire rope bends around sheaves and drums should be kept at a minimum by the use of large sheaves and drums; or else a smaller rope of higher breaking strength or a more flexible rope should be used.

Business Notes

FATE-ROOT-HEATH CO. has placed John H. Neafie and George H. Fanning in charge of its district sales office for the New York territory with offices at 50 Church Street.

ALBERT ROBERTS, formerly of the Grip Nut Co. of Chicago, Ill., has been appointed southern manager of the Duff Mfg. Co. with offices in the Candler Building, Atlanta, Ga.

JOSEPH T. RYERSON & SON, INC., Chicago, has taken over the reinforcing bar division of the Penn Metal Co. of Boston. Sizes and tonnage carried in stock will immediately be increased, and general sales offices have been opened at 677 Concord Ave., Cambridge, Mass., in order to give steel service to the New England territory.

PORTLAND CEMENT ASSOCIATION has moved its general offices and research laboratory into its new building on Grand Avenue and Dearborn St., Chicago. The entire building is occupied by the association. For the past ten years the general offices have been in the Conway Building, while the laboratory has been located in the Lewis Institute. The latter has heretofore been conducted cooperatively by the Institute and the Association.

Equipment and Materials

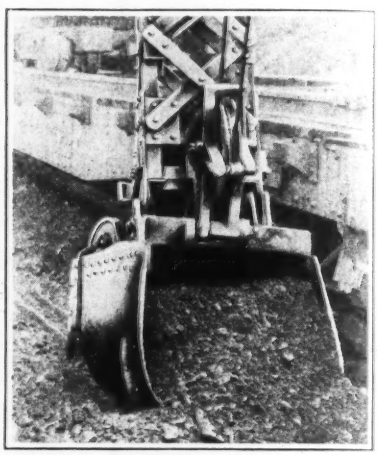
Electric Vertical-Capstan for Spotting Railway Cars

A vertical-capstan powered by an electric motor forms a self-contained unit designed by H. W. Caldwell & Son Co., 1700 S. Western Ave., Chicago, for spotting railway cars where switch engines are not always available or economical. Two sizes of equipment are available, the smaller size having a speed of 40 to 60 ft. per min. while moving one, two or three cars and the larger having a speed of 26 to 42 ft. per min. moving three to six cars. The capstan is especially rugged, an extra long upper bearing being used for the vertical shaft. A large flange on the lower edge fits over the end of the bearing, tending to reduce the bending moment on this shaft which is required to take the load from the rope pull. An automatic oiling system is used, consisting of an upper and a lower reservoir. The oil is distributed by the motion of the gears passing through the two reservoirs.

Special Type Dippers Designed for Railroad Work

Two new dippers have been announced by the American Hoist & Derrick Co., St. Paul, Minn., for application to its railroad locomotive ditchers.

A special dipper stick on which the



dipper is set at a rakish angle to permit it to dig in close to the end of the ties has been designed for ballast cleaning work. This dipper developed from experiments made by C. Yoder, engineer maintenance of way, New York Central Railroad, in which he used his regular ditching shovel to dig ballast. The new shovel is always operated over the right-hand side of

the flat car on which it works. Thus a gondola for the spoil material must be placed at either end of the ditcher car. The dipper loads ballast from one side of the track into one gondola; rotating

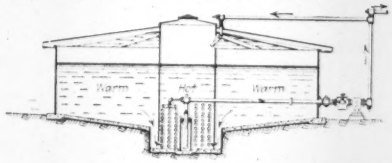
through 180 deg. it operates on the opposite side of the track loading ballast into the other gondola. It cuts aproximately 20 inches below the ties. This dipper is shown in the upper illustration.

The second dipper, shown in the lower illustration, is a 2-yd. snow scoop similar in design and operation to the ditching dipper with which it is readily interchangeable. However, it is much lighter in proportion to its size, weighing only 3,000 lb. Instead of the teeth used on the ditching dipper, it employs a sharp cutting edge which can bite into frozen snow.

Asphalt Storage System for Paving Contractors

An apparatus adapted for quick erection, frequent moving and for low temperature storage of asphalt in quantities sufficient to keep a plant busy regardless of ordinary delays in the arrival of tank cars has been developed by the Simplicity System Co., Chattanooga, Tenn. It further provides for automatically heating and drawing out of storage the asphalt requirements of the plant and for delivering same to the point of use.

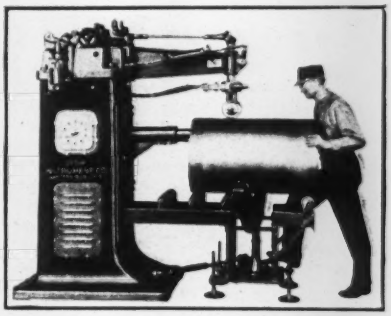
The system as illustrated embodies a large circular steel tank in the center of which is located a small bottomless tank containing electrically welded steam heating coils. The asphalt in the inner tank is kept very hot by means of the coils and may be drawn off by the pump. This used asphalt is automatically replaced by fresh asphalt from the outer tank as indicated by the arrows. Means for agitation of



the hot chamber is provided by the overhead pipe which constantly returns a portion of the pumpage to the inner tank. The operation is continuous and the apparatus heats only the asphalt about to be used, so that no heat is wasted on the material in reserve storage which remains at a low temperature until needed. The sizes range from 100 tons to 400 tons capacity, equivalent to 25,000 gal. to 100,000 gal.

Electric Seam Welding of Sheet Steel

Prior to 1921 there were a few installations of electric seam welding machines built on the principle of the continuous travel of a copper roll with the continuous application of current. However, this method was not widely successful because the continued application of current accumulated heat, creating a different heat condition at the beginning and end of the weld. German manufacturers had progressed beyond the rest of the world in seam welding, using a so-called "roll-step method." The work passed between rolls in a step-like manner and current was applied only at the rest period. This was claimed to entirely eliminate the accumulation of heat. Good welds resulted, but production did not exceed about 3 ft. per minute. The Gibb Welding Machines Co., Bay City, Mich.,



STATIONARY ROLL TYPE WELDING MACHINE

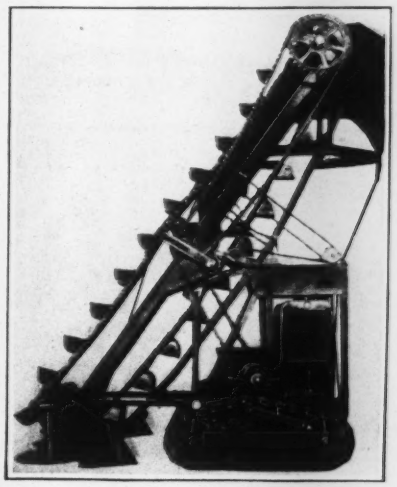
imported these machines until their own engineers developed the dual speed method, which provided a slow speed during the welds and fast speed between welds. A speed of about 4½ ft. per minute could be maintained..

Experimentation has now developed the periodic interruptions of current without interruptions in travel, which method increases further the welding speed. The surges of current have the penetrating effect without accumulating heat.

Elevating Bucket Loader for Sand Handling on Road Jobs

An elevating bucket loader known as model 25 has been developed by the Barber-Greene Co., Aurora, Ill., for the use of road contractors in handling sand. Model 42 bucket elevator, which this company has been manufacturing for some time, is of a larger size and is suitable for handling stone. The two pieces of equipment can be efficiently used together at a road contractor's material plant.

The new loader is equipped with a 20 hp. Continental Red Seal gas engine. A General Electric 10-hp. motor may



be furnished if desired. All driving machinery is completely housed from dirt.

The buckets are 18 in. by 8 in. spaced on 18 in. centers. A 30-inch patented revolving disk feed and scraper is used. The head shaft is 14⅝ ft. from the ground, which is approximately the same as that for the type 42 loader. The capacity is rated at one cu.yd. per min. in free flowing material, and the weight of the loader is 9,500 lb. In all other particulars, it is the same as the type 42 loader.

Publications from the Construction Industry

Excavators—INSLEY MFG. CO., Indianapolis, Ind., has issued Catalog No. 49 which is devoted to its excavator. Illustrations and text are given showing and describing the machine in use with its various attachments as a shovel, ditcher, crane, and skimmer scoop.

Road Rollers—HUBER MFG. CO., Marion, Ohio, describes its 1926 model motor roller in a new 23-p. catalog just issued. Illustrations of the details and also of the machine in actual use are features of the booklet.

Compressors—THE RIX CO., INC., San Francisco, made available two new bulletins PC102 and 103. The first describes the portable gasoline engine driven compressor outfit which is a direct connected self-contained unit. The second bulletin describes the type of portable compressor in which the engine and compressor are connected through the usual long shaft.

Perforated Metal Work—G. A. HARVEY & CO., LTD., Woolwich Road, London S. E. 7, has issued a catalog devoted to decorative design of perforated metal. Many patterns are shown for radiator guards, pipe guards, grills, ventilator panels, and other similar work all available in a variety of finishes.

Window Sash—DAVID LUPTON'S SONS CO., Philadelphia, features its continuous window sash in a new catalog, but also devotes about half of the 44 pp. to the roof design and the operating device that is used with this continuous sash. A list of the company's other analogous products is also given.

Water - Works—PITTSBURGH - DES MOINES STEEL CO., 905 Curry Bldg., Pittsburgh, Pa., has issued No. 3 booklet on municipal water-works. The 46 pp. of the booklet are devoted to the subject of gravity pressure water systems through the medium of elevated steel tanks. Some space is also given to steel standpipes and reservoirs.

Valves—ROSS VALVE MFG. CO., INC., Troy, N. Y., devotes its catalog No. 26 to its regulating valves for water, steam, air and oil.

Engineering News-Record Statistics of the Construction Industry

May 6, 1926 — *in the United States* — Vol. 96, No. 18

Engineering News-Record CONSTRUCTION COST Index Number (1913 = 100)

MONTHLY

January, 1925 to Date

May, 1926	207.30
April, 1926	207.05
May, 1925	207.20
Peak, June, 1920	273.80
1913	100.00

1925

Jan.	210.40	May	207.20	Sept.	202.10
Feb.	209.70	June	204.60	Oct.	205.35
March	210.20	July	204.60	Nov.	205.95
April	209.55	August	204.60	Dec.	205.95

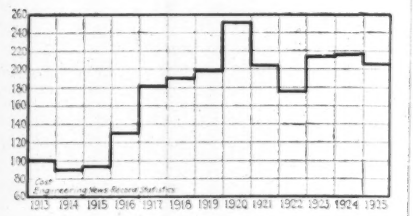
1926

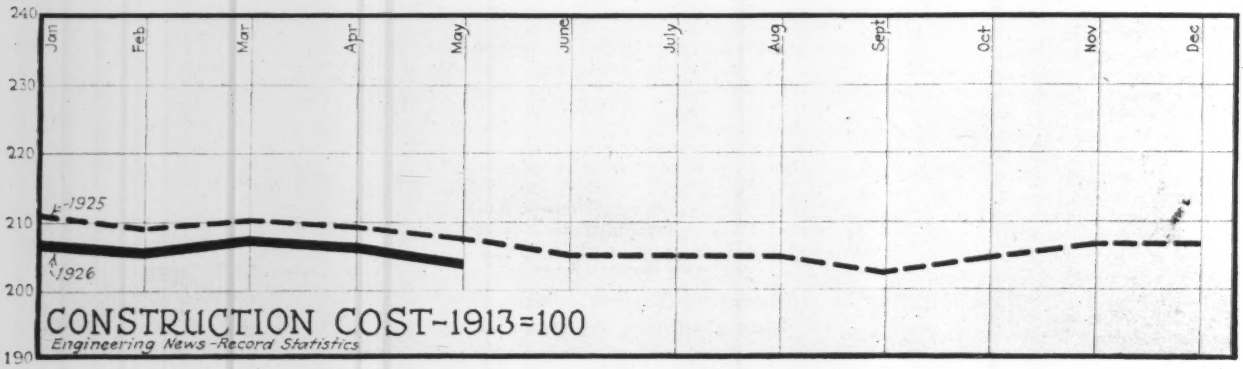
Jan.	207.15	Feb.	206.55	Mar.	207.65

ENGINEERING NEWS-RECORD'S Construction Cost Index Number is 0.04 per cent above May, 1925. The steady decline in materials prices, generally, has, to a great extent, compensated for the increased cost of labor. The average rate for common laborers is 55c. per hr. for the entire country as compared with 54½c. one month ago and 54c. at this time last year. Thus general construction cost is 24 per cent under the peak and 107 per cent above the 1913 level.

YEARLY

1913 to 1925





Engineering News-Record CONSTRUCTION VOLUME Index Number (1913 = 100)

MONTHLY

January, 1925 to April, 1926

April, 1926	233
March, 1926	240
April, 1925	211
Peak, August, 1925	266
1913	100

1925

January	141	May	209	September	262
February	145	June	214	October	233
March	161	July	178	November	194
April	211	August	266	December	206

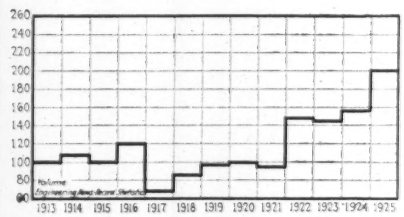
1926

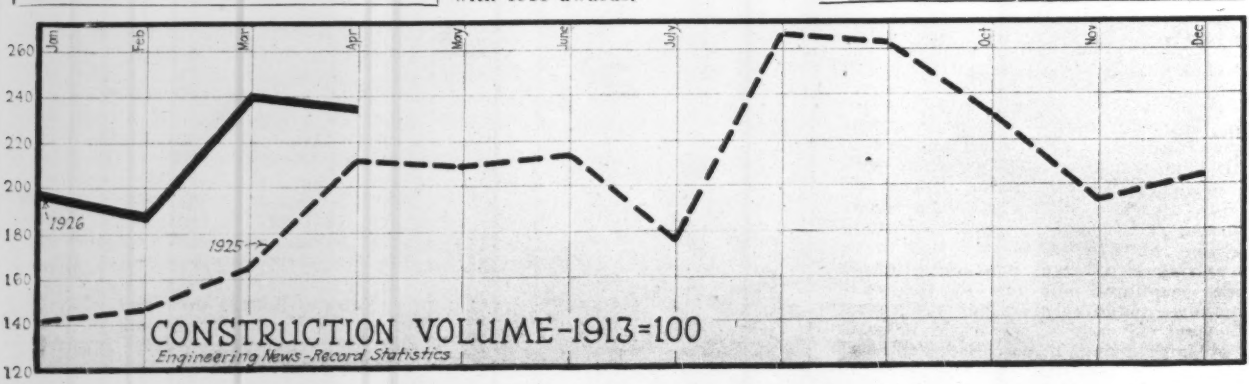
January	198	February	187

ENGINEERING NEWS-RECORD'S Constructon Volume Index Number is 233 for the month of April, and 201 for the whole of 1925, as against 100 for 1913. This means that the actual volume of construction in 1925 (not the mere money-value of the contracts let that year) is 101 per cent above the volume of construction for 1913. The monthly volume number, 233 for April, 1926, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

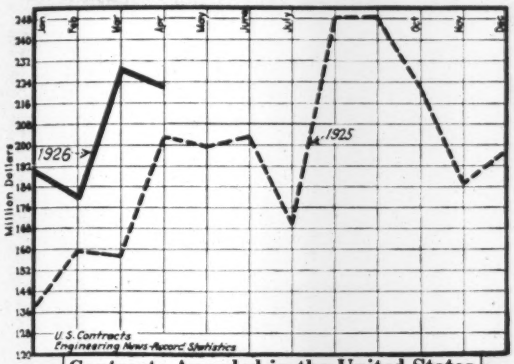
YEARLY

1913 to 1925

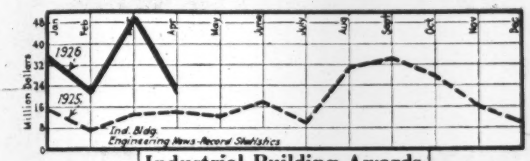




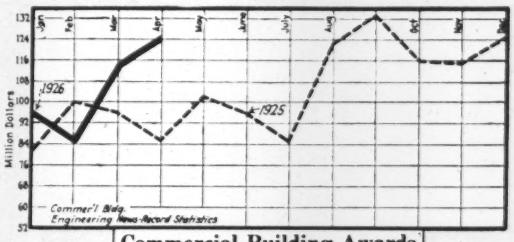
Monthly Statistics of the Construction Industry



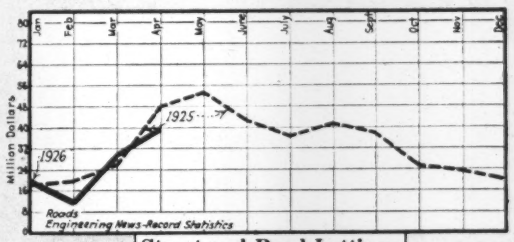
Contracts Awarded in the United States
Reported in E. N.-R.



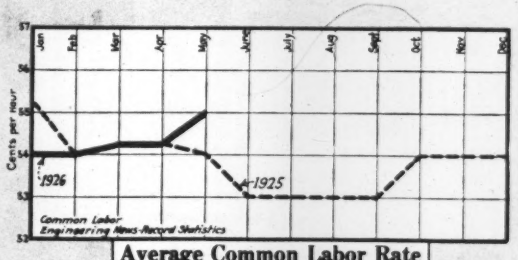
Industrial Building Awards
$40,000 and Over



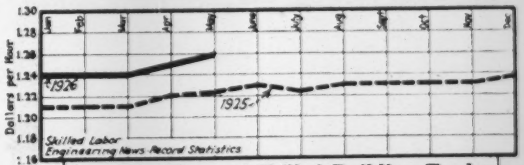
Commercial Building Awards
$150,000 and Over



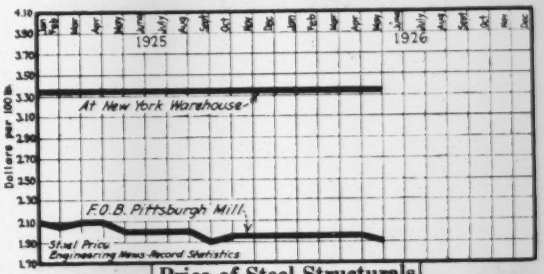
Street and Road Lettings
$25,000 and Over



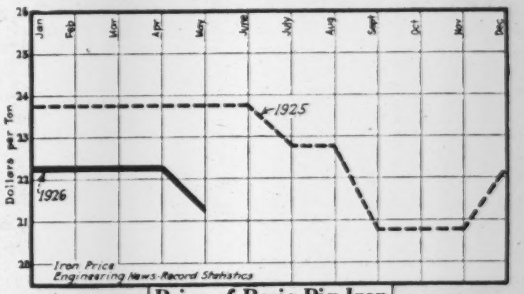
Average Common Labor Rate
Pick and Shovel Men



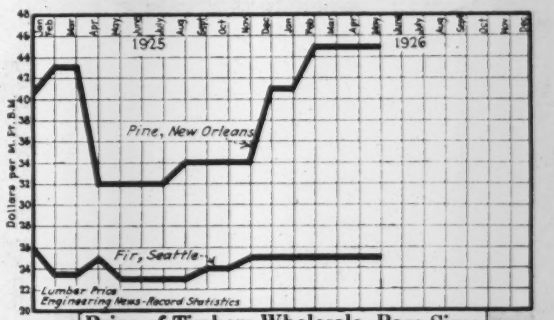
Average Wage of Skilled Building Trades
Bricklayers, Carpenters and Steel Erectors



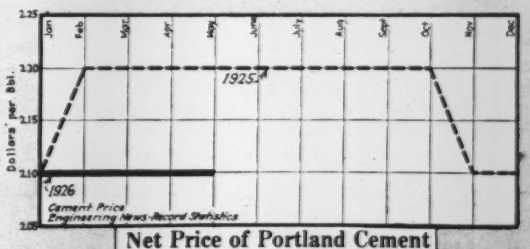
Price of Steel Structurals
Shapes 3-In.; Plates ¼-In.



Price of Basic Pig Iron
F.o.b. Pittsburgh

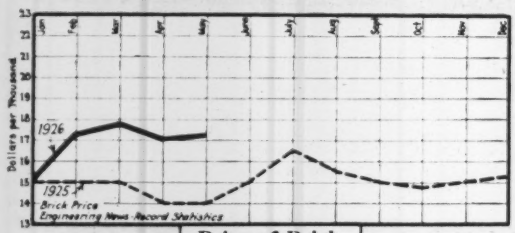


Price of Timbers, Wholesale, Base Sizes
Car Lots to Contractors

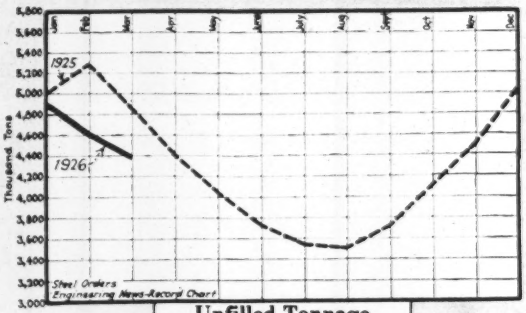


Net Price of Portland Cement
Car Lots, F.o.b. Chicago

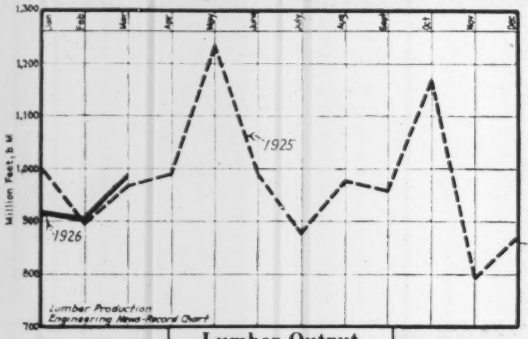
Monthly Statistics of the Construction Industry



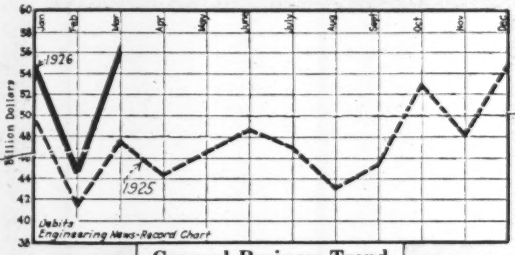
Price of Brick
At Dock, New York



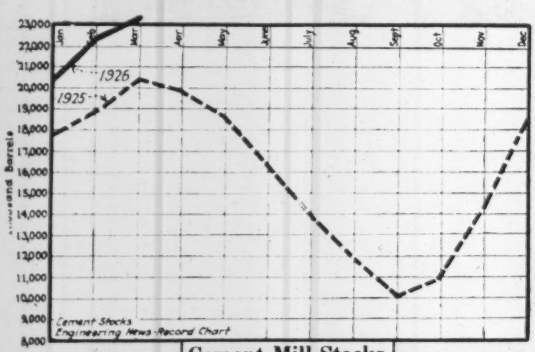
Unfilled Tonnage
On Books of U. S. Steel Corp.



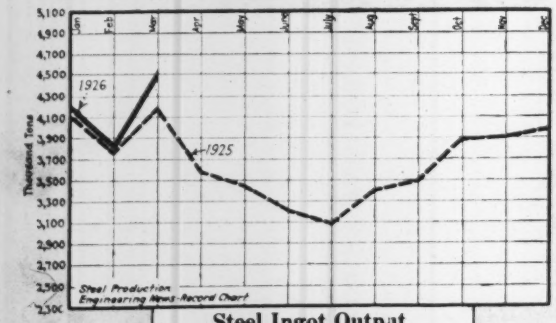
Lumber Output
Nat. Lumber Mfrs. Assn.



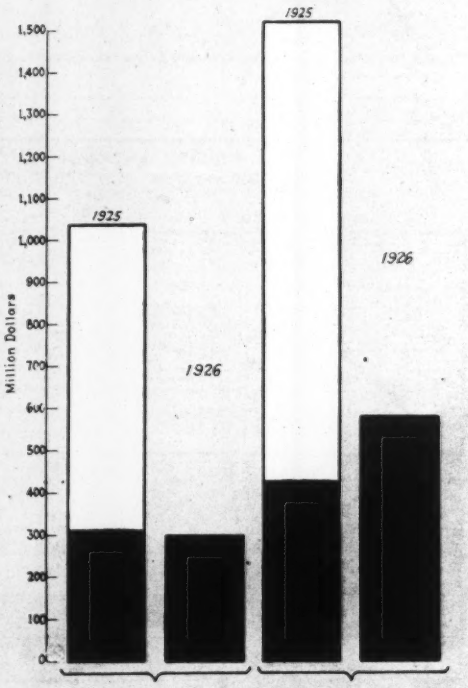
General Business Trend
Bank Debits—Federal Reserve



Cement Mill Stocks
Bureau of Mines



Steel Ingot Output
Gross Tons; Am. Iron and Steel Inst.



Public—Contracts—Private
Jan. 1 to date
Reported by E. N.-R.

This Year to Date Ahead of Corresponding Period of 1925 in Both Contracts and Projected Work

Proposed Construction Other Than Buildings Gains

INCREASED cost of labor in several of the most important industrial centers throughout the country has evidently had little effect upon contract letting. The April total of engineering construction work for the entire U. S. was $280,046,000, against $254,149,000 during the same month last year. Those who awarded these contracts, did so after due consideration of the possibilities of advances in certain of the wage schedules, effective May 1.

By engineering construction work is meant water-works and excavating projects valued at $15,000 or over; other public works, $25,000 and up; industrial buildings at a minimum of $40,000 and commercial and other buildings, $150,000 and higher.

A total of $881,045,000 worth of engineering contracts was let between Jan. 1 and May 1, this year. Buildings represented $600,469,000 of this and other construction, $280,576,000. This is compared with $735,573,000 for the corresponding period last year. Of this total, buildings accounted for $457,354,000 and other construction, $278,219,000. The gain in buildings amounted to 31 per cent and that of other construction, one per cent.

Further evidence that the peak of the building boom has not been reached and passed, is found in a comparison of totals for proposed work, definitely reported as such, for the period Jan. 1 to May 1, this year and last.

The total for the first four months of 1926 was $2,191,156,000 in engineering projects, reported as proposed. Of this, $1,260,761,000 was for buildings and $930,395,000 for other work.

During the corresponding period last year, the total was $1,809,343,000; buildings amounting to $1,027,963,000 and construction other than buildings, $781,380,000.

Projects definitely reported as proposed offer a better index of construction activity than building permits alone. April proposed work totaled $537,385,000, against $392,400,000 for the same month last year. Proposed construction other than buildings was 83 per cent greater in April than for the same month last year, while buildings were 15 per cent ahead.

Past experiences lend strength to the belief that considerably more than 75 per cent of these projects will mature as contracts before Aug. 1, 1926. Present gains in projected work are almost sure to be reflected in similar increases in the contract volume three months hence, compared with the corresponding period in the peak year 1925.

Value of Contracts Let in the United States and Canada During April, 1926

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date U.S.	Canada
Water-works	$147,000	$1,098,000	$1,539,000	$1,192,000	$1,166,000	$2,286,000	$7,428,000	$22,836,000	$131,000
Sewers	.....	1,167,000	330,000	2,448,000	2,154,000	1,127,000	7,226,000	26,028,000	670,000
Bridges	41,000	2,333,000	792,000	1,164,000	1,442,000	429,000	6,201,000	20,442,000	.....
Excavation, drainage, irrigation	.....	130,000	685,000	94,000	23,000	838,000	1,770,000	8,288,000	.....
Streets and roads	712,000	10,117,000	10,239,000	10,659,000	14,352,000	4,125,000	50,204,000	112,653,000	1,657,000
Industrial buildings	8,301,000	2,863,000	1,852,000	4,143,000	4,356,000	5,575,000	27,090,000	134,506,000	2,190,000
Commercial buildings	17,661,000	53,469,000	5,942,000	43,293,000	17,372,000	18,863,000	156,600,000	465,963,000	9,822,000
Federal Government	30,000	177,000	2,827,000	583,000	93,000	2,059,000	5,769,000	16,180,000	.....
Unclassified	579,000	1,822,000	539,000	2,773,000	7,211,000	4,834,000	17,758,000	74,149,000	2,214,000
April, 1926	$27,471,000	$73,176,000	$24,745,000	$66,349,000	$48,169,000	$40,136,000	$280,046,000	$881,045,000	$16,684,000
March, 1926	11,983,000	99,556,000	25,140,000	46,524,000	24,565,000	22,552,000	230,320,000	.....	10,818,000
April, 1925	18,954,000	85,627,000	14,728,000	64,971,000	38,590,000	31,279,000	254,149,000	.....	10,934,000
Jan. 1 to date, 1926	56,283,000	307,146,000	107,193,000	191,232,000	118,808,000	100,383,000	881,045,000	.....	39,638,000
Jan. 1 to date, 1925	62,730,000	253,587,000	59,469,000	133,662,000	126,767,000	99,358,000	735,573,000	.....	19,877,000

Labor Rates and General Conditions Throughout the Country

Trend In Skilled Building Trades Continues Upward

IT IS believed by some that a steadily declining wholesale market portends business depression and by other and equally reliable authorities that ease in money rates is seldom present at a time of marked recession in trade and industry. Both of these conditions exist at the present time. The trend of wholesale prices, building materials included, has been downward for the past three months or more. Two weeks ago the New York Federal Reserve rediscount rate was returned to the Jan. 7 level of 3½ per cent, a decline of half a point, indicating that the bank officials regard the recent wave of speculative excess as having definitely subsided.

If those in control of the vast financial resources of the nation were not confident of the future earning power of American industry, no such inducement as the present lowered money rate would have been offered.

The declining trend in prices means that recession in demand has already set in and that the next development will be further curtailment of production with resultant increase in unemployment of labor. This will mean a greater availability of common laborers for construction work but it will not materially affect the comparatively high wage schedules of skilled building trades mechanics. The trend of labor cost in the latter class is decidedly upward in twenty of the most important industrial centers throughout the country.

Briefly, some of the outstanding points in the building trades labor stiuation are outlined as follows:

New York bricklayers are signed up for three years at a base rate of $14 per day as against $12 formerly, the new rate effective May. 1. Barmen on demolition work were advanced, during the past month, to $1.17½ per hr., against $1.05; their laborers will receive $1.05, compared with the old rate of 95c. per hr. The steamfitters and helpers strike has finally reached a settlement. The former receive an advance of $1.50 per day over the old rate of $10.50 and the latter, 50c. above the former wage of $8 per day.

Cleveland is experiencing the tenth week of a strike among painters, glaziers and common laborers. About 13,000 building mechanics are idle as a result of the strike not to speak of the closing down of several building materials supply warehouses because of scarcity of shipping orders on the tied-up jobs. The painters and glaziers demand an increase of 12½c. per hr. over the present rate of $1.25, together with a five-day week. The common laborers are out for a rise of 12½c. per hr. over the 87½c. now being paid most of the men in this class.

Chicago faces a plasterers' strike scheduled to begin tomorrow morning (May 7) at which time the men will report for work but with the intention of tying up those operations on which the demanded wage advance of $2 per day is refused.

The men are getting a base rate of $12 per day and the increase, if granted, would adversely affect the whole line-up of the skilled trades, since the other crafts would demand commensurate advances, it is believed. The plasterers also requested the five-day week but are reported as not being firm on this point.

The plasterers union, among other trades, accepted the Landis award and it is expected that the citizens' committee to enforce the Landis decision will stand in favor of the employers.

The walk-out of San Francisco carpenters on jobs where non-union men were being employed, has evidently had little effect upon the construction ac-

Current Building Trades Wage Rates Per Hour

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.70	$0.70	$0.50	.....	$0.75	$0.25@.50
Baltimore	1.62½@1.75	1.00@1.10	1.00@1.12½	1.00	80.65	1.12½	.40
Birmingham	1.00@1.50	.35@.87½	.75@1.00	.50@.75	.....	.75@1.75	.20@.40
Boston	+1.40	+1.25	1.25	+.79	+1.15	1.25	+.50@.74
Cincinnati	1.50	1.31¼	1.31¼	.95	+1.31¼	1.31¼	—.45@.58
Chicago	1.50	1.37½	1.37½	.87½	1.37½	1.37½	.82½@.87½
Cleveland	1.50	1.25	1.30	.87½@1.00	1.00	1.50	.87½@1.00
Dallas	1.62½	1.12½	+1.12½	.40@.75	.87½	1.00	.30@.50
Denver	1.62½	1.12½	1.12½@1.18¾	.81¼@.87½	1.00	1.15⅝	.35@.55
Detroit	1.50	.70@1.00	.85@1.00	.90	.85@1.00	1.12½	.50@.60
Kansas City	1.50	+1.25	+1.12½@1.25	.90	1.12½	1.25	+.40@.75
Los Angeles	+1.37½	1.00	1.00	.87½	.80	1.00	.50
Minneapolis	1.12½@1.25	.87½@90	.87½	.71½	....	.87½	.45@.55
Montreal	1.00	.80	.56¾	.30@.35	.50	.80	.25@.30
New Orleans	1.25	.90	1.00	.65	.85	1.25	.35@.40
New York	1.50	1.50	1.50	1.00	1.00@1.12½	1.50	.62½@.75
Philadelphia	1.62½	1.12½	1.02¼	1.12½	1.00	1.12½@1.25	.45@.50
Pittsburgh	1.62½	1.50	1.37½@1.50	1.12½	....	+1.50	.80
St. Louis	1.75	1.50	1.50@1.65	1.15@1.25	1.50	1.50	.45@1.00
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.37½	1.12½	1.00@1.12½	1.00	1.00@1.12½	1.12½	.50@.62½

tivities of the city. The situation amounts to a test of strength between the American plan and the union.

St. Louis painters demand an increase of 7½c. per hr. over the present scale of $1.30. The question of the five-day week has also been approached but that, together with the wage advance, has been stoutly resisted by the employers. Asbestos workers also request an increase of 17½c. over the current rate of $1.25 per hr.

Kansas City, Mo., employers refuse to grant wage advances demanded May 1 by the plasterers, carpenters, tile setters, steam fitters, marble setters, plumbers, lathers and hoisting engineers.

Philadelphia electricians demand an increase of 12½c. per hr.; structual iron workers are agitating for closed shop conditions in their trade. Carpenters' and cement finishers' strikes abandoned; no other major labor disturbances are in sight.

Denver carpenters will receive an advance of $1 per day, effective June 1. Building trades mechanics are reported only 60 per cent employed in this district.

Los Angeles tile and marble workers are returning to work after an unsuccessful strike. There is less unemployment present in this district but construction is slightly below the usual volume.

Surplus of common laborers is reported in Boston, Montreal and Birmingham.

Monthly Prices of Construction Materials

Ups and Downs of the Market

PRICES of construction materials have shown a consistently downward trend since the first of the current year. This, of course, is for the nation as a whole; small local adjustments frequently running contrary to the general trend. At this time last year a similar downward tendency was in evidence, which continued until August, 1925. From August of last year until January, 1926, the price movement was upward.

Pig Iron—Buying continues slow; prices, however, have remained fairly steady during the past week. Eastern Pa. No. 2X and basic are down 40c. per ton at Philadelphia, compared with the Apr. 1 level; No. 2 fdry., basic and bessemer are off $1 at Pittsburgh.

Railway Supplies — Aside from a slight decline in re-rolled rails at Pittsburgh, little change occurred during the month in prices of these materials.

Pipe—Cast-iron pipe is a trifle stronger in the New York district, with prices up about $1 per ton from levels of a month ago and 50c. under May, 1925. The Southern market remains unchanged. April water-works lettings were about 30 per cent under those of the same month last year. Compared with a year ago, sewer pipe, 8-in. and under, is higher; 10 to 24-in., inclusive, is under May, 1925; sizes 27-in. and larger, show no change. April sewer lettings were 16 per cent heavier than in 1925.

Road and Paving Materials—Street and road contracts for April were 17 per cent under those of the same month last year. Aside from slight fluctuations in paving materials at Boston, New Orleans and Kansas City, no price changes occurred in the other eighteen cities reporting regularly to *E. N.-R.*

Sand, Gravel and Crushed Stone—Gravel rose 40c. and sand, 5c. per cu.yd. in New Orleans and crushed stone advanced 50c. in Kansas City, Mo., during the month. Sand, however, dropped 38c. per ton at Detroit; no changes developed in the other eighteen cities.

Lime and Cement—Five out of seven price changes occurring in lime, during the past month, were advances. Slight declines in cement are reported in New Orleans, Los Angeles and Montreal, compared with the Apr. 1 level; quotations hold firmly in forty-three other centers.

Brick and Hollow Tile—The price tendency of brick is sharply upward; tile quotations show little if any deviation from the Apr. 1 level throughout the entire country.

Structural Steel—Demand is active in steel plates, particularly for ship building; the minimum mill quotation now being $1.90 per 100 lb. as against $1.80 on Apr. 1. Requirements are a trifle lighter than a month ago in steel structurals, automotive and railway materials. Reinforcing bars have settled at about $2 per 100 lb., Pittsburgh. Shapes are practically on the same price basis as plates.

Lumber—Market exhibited slowness during the past month but with signs of improvement during May. Some activity was evident in common boards, flooring, ceiling, lath, car decking, railroad material and special cutting. Most of the price changes developing at present are in an upward direction.

Miscellaneous—Prices are a trifle firmer for galvanized steel sheets, linseed oil and explosives.

E. N.-R. Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton f.o.b.:

	May 6	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25@2.75)	$24.05	$24.05
Northern Basic	24.27	23.27
Southern Ohio No. 2 (silicon 1.75@2.25)	24.27	23.27
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25@2.75)	28.37	27.37
BIRMINGHAM		
No. 2 Foundry (silicon 2.25@2.75)	22.00	22.00
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	*23.76*	24.26
Virginia No. 2 (silicon 2.25@2.75)	29.17	29.17
Basic	*22.76*	23.26
CHICAGO		
No. 2 Foundry Local (silicon 1.75@2.25)	23.00	23.00
No. 2 Foundry Southern (silicon 2.25@2.75)	26.55	26.55
PITTSBURGH, including freight charge ($1.76) from the Valley		
No. 2 Foundry Valley (silicon 1.75@2.25)	*21.27*	23.77
Basic	*21.27*	23.77
Bessemer	*21.27*	23.77

SCRAP—The prices following are f.o.b. per ton paid by dealers:

	New York	Chicago	Birmingham
No. 1 railroad wrought	$14.75	*$12.00@$12.50*	*$12.00@*$13.00
Stove plate	*10.25*	*14.00@ 14.25*	14.00@ 14.50
No. 1 machinery cast		*16.25@ 16.75*	17.00@ 17.50
Machine shop turnings	*9.50*	*6.75@ 7.25*	8.00@ 8.50
Cast borings	*11.25*	*9.50@ 10.00*	8.00@ **9.00**
Railroad malleable	16.50	*14.75@ 15.25*	*16.00@* 17.00
Re-rolling rails	*12.75*	*13.75@ 14.25*	*15.00@ 16.00*
Re-laying rails	23.50		21.00@ 22.00
Heavy melting steel	*11.25*	*11.25@ 11.75*	13.00@ 14.00

Railway Supplies

STEEL RAILS—The following quotations are per ton f.o.b. for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh May 6	Pittsburgh One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00	
Standard openhearth rails	43.00	43.00	43.00	43.00	$51.00
Light rails, 8 to 10 lb.	35.00	34@36	34@36	1.80@1.90	2.05*
Light rails, 12 to 14 lb.	35.00	34@36	34@36	1.80@1.90	1.88*
Light rails, 25 to 45 lb.	35.00	34@36	34@36	1.80@1.90	1.84*
Re-rolled rails	*30@33*			34@36	17.50@18.00

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, white oak, plain	$1.35	$1.65
Chicago, empty cell creosoted	1.70	2.00
Chicago, zinc treated	1.50	1.80
San Francisco, green Douglas fir	.84	1.14
San Francisco, empty cell creosoted, Douglas fir	1.70	2.25
St. Louis, white oak, plain	1.15	1.45
St. Louis, zinc treated	1.55	1.85
St. Louis, red oak, plain	1.05	1.35
St. Louis, sap pine-cypress	.90	1.20
Birmingham, white oak	1.25	1.45

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for carload lots, together with the warehouse prices at the places named:

	Pittsburgh May 6	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.80	$2.80	$3.55	$3.65	$4.35	$3.00
Track bolts	3.90@4.15	3.90@4.25	4.55	**4.40**	5.85	3.90
Standard section angle bars	2.75	2.75	3.40	3.25@3.75	4.00	4.15

Pipe

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62	50½	1 to 1¼	30	12

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60	49½	1 to 1½	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

STEEL PIPE—From warehouses at the places named the following discounts hold for welded steel pipe:

	Black New York	Black Chicago	Black Birmingham	Black St. Louis
1 to 3 in. butt welded	53%	58%	62%	48%
2½ to 6 in. lap welded	48%	52%	59%	46%

	Galvanized New York	Galvanized Chicago	Galvanized Birmingham	Galvanized St. Louis
1 to 3 in. butt welded	39%	47%	50½%	36%
2½ to 6 in. lap welded	35%	44%	47½%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36—5% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	Birmingham	Burlington, N. J.	New York May 6	New York One Year Ago
4 in.	$45.00@46.00	**$53.00@55.00**	**$55.60@57.60**	$56.60@57.60
6 in. and over	41.00@42.00	**49.00@51.00**	**51.60@53.60**	52.60@53.60

	Pittsburgh	Chicago	St. Louis	San Francisco
4 in.	$53.20@54.20	$53.20@54.20	$51.50	$56.00
6 in. and over	49.20@50.20	49.20@50.20	47.50	52.00

Gas pipe and Class "A," $4 per ton extra.

CLAY DRAIN TILE—The following prices are per 1,000 lin.ft.:

Size, In.	New York May 6	New York One Year Ago	St. Louis	Birmingham	San Francisco	Dallas
3	*$45.00*	$48.00	$40.00	$45.00		$73.00
4	*55.00*	50.00	40.00	56.00	$76.50	110.00
5				80.00	97.75	118.00
6	90.00	92.00	70.00	100.00	127.50	150.00
8	160.00	160.00	170.00	165.00	212.50	210.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3		*$0.10*	$0.10		$0.09	$0.12	
4		*.10*	.10	$0.10	.09	.15	$0.15
5		*.1225*	.135		.13½	.18	.18
6	$0.21	*.1375*	.135	.14	.13½	.21	.21
8	.35	*.225*	.21	.225	.21	.30	.325
10	.52	*.2625*	.315	.315	.31½	.42	.476
12	.66	*.3375*	.45	.405†	.40½	.56	.612
15	1.14†	.45	.54	.675†	.54	.92	1.02
18	1.65†	*.625*	.75	.945†	.75	1.32	1.53
20	1.98†	*.75*	.90	1.26†	.90		
22	2.65†	*1.00*	1.20		1.20		1.564
24	2.97†	*1.125*	1.35	1.62†	1.35	2.16	2.04
27	4.65†	2.405	2.665	2.45†	2.75	3.00	3.34
30	5.16†	2.664	2.952	3.00†	3.75	3.60	4.06
33	6.98†	3.60	3.96	3.55†	4.50		4.99
36	8.00†	4.10	4.51	3.95†	5.00		5.42

	3	5	8	12	24	36
Boston	$0.13	$0.20	$0.30	$0.60	$2.00†	$5.50†
Minneapolis			.25	.45	1.50	4.56
Denver	.135*	.18*	.27	.47	1.70	
Seattle	.14		.35	.72†	2.60†	
Los Angeles	.1625	.195	.275	.495	1.65	
New Orleans	**.116***	**.277***	**.295**	.463	**1.785**	
Cincinnati	.105	.1575	.245	.4725	1.575	4.715
Atlanta	.10*	.15*	.25	.425	1.625	
Montreal	.68‡	.45†	.70	1.35	4.50†	
Detroit	.105	.1575	.245	.4725	2.16†	5.6375†
Baltimore	.111	.166	.259	.499	1.665	4.92
Kansas City, Mo.	.15*	.21*	*.30*	*.45*	*1.90†*	3.80†
Philadelphia	.11	.17	.26	.50	1.67	3.80

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

Road and Paving Materials

ROAD OILS—Following are prices per gallon in tank cars, 8,000 gal. minimum f.o.b. place named:

		May 6	One Year Ago
New York, 45% asphalt	(at terminal)	$0.065 @ $0.07	$0.065 @ 0.07
New York, 65% asphalt	(at terminal)	.0675@ .0725	.0675@.0725
New York, binder	(at terminal)	.07 @ .075	.07 @.075
New York, flux	(at terminal)	.07 @ .075	.07 @.075
New York, liquid asphalt	(at terminal)	.07 @ .075	.07 @.075
St. Louis, 40@50% asphalt		.055	.0527
St. Louis, 50@60% asphalt		.0575	.0538
Birmingham, 55% asphalt		.0475	.0475
Dallas, 45% asphalt		.0495	.0495
Dallas, 55% asphalt		.0455	.0455
Dallas, binder		.061	.061
San Francisco, binder, per ton		12.00*	12.00*

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

E. N.-R. Prices of Construction Materials

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Texas*)	$23.00	$18.50
Boston (*Mexican*)	**23.00**	18.50
Chicago (*Texas*)	27.00	23.00
San Francisco, *f.o.b. refinery*, Oleum, Cal.	18.00	12.00
Dallas (*Texas*)	27.10	21.10
Seattle, "*D*" *grade, California, f.o.b. Richmond*	19.50	13.50
Denver (*California*)	24.00	.....
Minneapolis, *f.o.b. Twin Cities (Standard)*	27.60	21.60
St. Louis (*Mexican*)	26.00	23.00
Baltimore (*Mexican*) (*f.o.b. refinery*)	22.50	18.50
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	24.60	20.40
Detroit (*Mexican*)	22.25	18.50
Cincinnati (*Kentucky Rock*)	.....	11.65
Maurer, N. J. (*Bermudez*)	30.00	.....
Maurer, N. J. (*Trinidad*)	23.00	.....
Philadelphia (*Mexican*)	20.00	18.00
Kansas City, Mo. (*Texas*)	27.30	22.30
Los Angeles ("*D*" *grade, California*)	*18.00	*12.00
Birmingham (*Mexican*)	27.00	21.00
New Orleans (*Mexican*)	*20.00*	17.00

* F.o.b. El Segundo Refinery. Drums used in New York.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade I)	5-in. granite, 30 blocks per sq.yd.	$147.00 per M.
San Francisco	Basalt block 4x7x8	70.00 per M.
Chicago	about 5x8x5 dressed	3.60 per sq.yd
	about 5x8x5 common	3.25 per sq.yd.
Boston	5-in. Granite	135.00 per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	3.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4x8x4	*2.75* per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	Granite, 4x8x4	1.65 per sq.yd.
Kansas City	Granite	3.15 per sq.yd.
Philadelphia	Granite	3.90@4.25 per sq.yd.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft. wide	$0.24 per sq.ft.
	Manhattan, 4 ft. wide	.24 per sq.ft.
	Queens, 5 ft. wide	.26 per sq.ft.
	6x24-in. cross-walk	1.30 per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5x16 in., 88c.; *St. Louis*: Class "A" straight, delivered, 5x18 in., $1.05 per lin.ft.; roundings, $1.60. *Birmingham*: Limestone, 5x18-in., $1.05 per lin.ft.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York	3	16	$2.40
New York	3½	16	2.70
Boston	3½	18	2.50
Chicago	4	16	2.25
Chicago	3½	16	2.10
St. Louis	3½	16	2.45
St. Louis	4	16	2.75
Seattle	4	16	Off market
Minneapolis	3½	16	*2.40*
Atlanta	3½	16	2.00
New Orleans	3	16	2.20
New Orleans	3½	16	2.30
New Orleans	4	16	2.40
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	.....
Cincinnati	3½	16	2.35
Kansas City	4	16	*3.00*
Philadelphia	4	16	None used

Construction Materials

SAND AND GRAVEL—Price for cargo or carload lots to contractor f.o.b., per cu.yd. is as follows:

	Gravel				Sand	
	1½ In.		¾ In.			
	May 6	One Year Ago	May 6	One Year Ago	May 6	One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.00
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	1.60	.....	1.60	.....	1.40	.....
St. Louis	1.45	1.45	1.45	1.65	1.08	1.18
Seattle	1.50	1.50	1.50	1.50	1.50	1.50
Dallas	2.38	2.38	2.38	2.38	2.00	2.00
Minneapolis	1.65*	1.65*	1.65*	1.65*	1.25	1.25
Cincinnati	1.40†	1.40†	1.40†	1.40†	1.35†	1.35†
San Francisco	1.80	2.15	1.80	2.15	1.40	1.50
Boston	1.50†	1.50†	1.50†	1.50†	1.00†	1.00†
New Orleans	**3.00**	2.60	**3.00**	2.60	**1.80**	1.75
Los Angeles	1.15†	1.30†	1.15†	1.30†	.90*†	1.20†
Atlanta	1.90†	1.90†	1.90†	1.90†	1.50†	1.40†
Detroit	1.45†	2.02	1.35†	2.02	*1.10*†	1.62
Baltimore	1.40	1.40	1.60	1.60	.70*†	.70*†
Montreal	1.25†	1.25†	1.25†	1.25†	1.25†	1.25†
Birmingham	2.00	2.00	2.00	2.00	1.50	1.45†
Philadelphia	2.10	2.10	2.10	2.10	1.50	1.50
Kansas City	4.00‡	4.00‡	4.00‡	4.00‡	.66*†	.66*†

New York—Grita, $1.75 per cu.yd.; ready mixed $1.85.
Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.
* At pit. † Per ton. ‡ Joolin chats.

CRUSHED STONE—Price for cargo or carload lots, per cu.yd. f.o.b. cars or job as follows:

	1½ In.		¾ In.	
	May 6	One Year Ago	May 6	One Year Ago
New York	$1.75	$1.75	$1.85	$1.85
Chicago	1.75	.....	1.87½	.....
St. Louis	1.93*	1.83*	1.93*	1.93*
Dallas	2.40	2.40	2.83	2.83
San Francisco	1.70	2.15	1.70	2.15
Boston	1.60*	1.60*	1.60*	1.60*
Minneapolis	1.75	1.75	1.75	1.75
Kansas City	**2.00**	1.50	**2.00**	1.50
Denver	2.50	2.50	2.50	2.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	2.50*	2.00*	2.50*	2.00*
Cincinnati	1.90*	1.96*	1.90*	1.96*
Los Angeles	1.40*	1.50*	1.40*	1.50*
Detroit	2.00*	1.50	2.00*	1.50
Baltimore	2.50	2.50	2.55	2.55
Montreal	1.80*	1.80*	1.50*	1.90*
Philadelphia	2.10	2.10	2.10	2.10
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	3.25*	3.25*	3.25*	3.25*
Birmingham	2.00	2.00	2.00	2.00

* Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plant

	1½-In	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Steubenville District	1.25	1.30	2.00	1.30
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa.	.....	.....	2.50	.....
Birmingham, Ala.	.80@.90	1.15	2.05	.....
Buffalo, N. Y., and Erie, Pa.	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.80	1.80	.....	1.75
Eastern Pa. and Northern N. J.	1.25	1.25	2.50	1.25
Western Pennsylvania	1.25	1.25	2.00	1.25
Longdale and Glen Wilton, Va.	1.25	1.25	2.50	.....
Toledo, Ohio	1.25	1.25	1.50	1.25

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
New York	$18.20	$12.00@$13.00	$3.50*	$2.25@2.75*
Chicago	20.00	18.00	.....	2.25*
St. Louis	24.00	20.00	2.10†	15.00‡
Boston	20.00	*18@14*	3.75*	3.00*
Dallas	**20.00**	.....	.....	**2.25***
Cincinnati	16.80	14.30	.....	13.40‡
San Francisco	.....	22.00	.....	1.60†
Minneapolis	25.50	21.00	1.60@1.70† (brown)	1.35†
Denver	24.00	.....	.....	2.70*
Detroit	18.50	15.00	.....	18.50‡
Seattle, *paper sacks*	24.00	.....	2.80†	
Los Angeles	25.00	18.00	3.50*	19.50‡
Baltimore	24.25	17.85	2.55†	
Montreal	.....	21.00	.....	10.00‡
Atlanta	**23.50**	13.00	2.20†	1.50†
New Orleans	24.00	*15.00*	2.50†	2.00*
Philadelphia	23.00	16.00	.....	
Kansas City	**19.50**	**18.50**	2.45†	2.10*
Birmingham	22.50	16.00	2.40†	1.85†

* Per 280-lb. bbl. (net). † Per 180-lb. (net). ‡ Per ton.

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, exclusive of bags:

	May 6	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	*1.35*	1.35
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	*2.60*	2.50
St. Louis (Carney)	2.35	2.35
Birmingham (Magnolia) pozzolan cement	2.40	2.40

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	May 6	One Month Ago	One Year Ago
New York, del. by truck	$2.50@$2.60	$2.50	$2.50@$2.60
New York, alongside dock to dealers	2.15	2.15	2.15
Jersey City	2.33	2.33	2.33
Boston	2.40	2.40	2.55
Chicago	2.10	2.10	2.20
Pittsburgh	2.09	2.09	2.19
Cleveland	2.29	2.29	2.39
Detroit	2.15	2.15	2.35
Indianapolis	2.29	2.29	2.41
Milwaukee	2.25	2.25	2.35
Duluth	2.09	2.09	2.19
Peoria	2.27	2.27	2.37
Cedar Rapids	2.34	2.34	2.44
Davenport	2.29	2.29	2.39
St. Louis	2.20	2.20	2.30
San Francisco	2.31	2.31	2.31
New Orleans	*2.30*	2.40	2.40
Minneapolis	2.32	2.32	2.42
Denver	2.85	2.84	2.84
Seattle	2.65	2.65	2.65
Dallas	2.05	2.05	2.05
Atlanta	2.35	2.35	2.30
Cincinnati	2.37	2.37	2.47
Los Angeles	*2.36*	2.52	2.80
Baltimore	2.35	2.35	2.50
Birmingham	2.40	2.40	2.40
Kansas City, Mo	2.35	2.35	2.28
Montreal	*1.45*	1.80	1.80
Philadelphia	2.41	2.41	2.41
St. Paul	2.32	2.32	2.42
Toledo	2.20	2.20	2.40

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind.	$1.85	Hudson, N. Y.	$2.05
Universal, Pa.	1.85	Leeds, Ala.	1.95
Steelton, Minn.	1.90	Hannibal, Mo.	1.95
Fordwick, Va.	2.05	Lehigh Valley District	1.95
Mitchell, Ind.	1.95	Wyandotte, Mich.	1.90
Iola, Kan.	1.85	Alpena, Mich.	1.75
Mason City, Ia.	1.90	Richard City, Tenn.	2.05
La Salle, Ill.	1.95	Kingsport, Tenn.	2.05

E. N.-R. Prices of Construction Materials

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Chicago District Mill	Warehouse: New York	St. Louis	Dallas	San Francisco
032	22	$0.97	$1.01	$1.39	$1.06	$1.13	$1.22
049	28	1.23	1.29	1.76	1.35	1.38	1.55
058	35	1.51	1.58	2.16	1.66	1.67	1.91
093	45	1.94	2.03	2.77	2.13	2.00	2.46
126	57	2.39	2.51	3.45	2.63	2.55	3.03
153	68	2.86	2.99	4.11	3.14	3.15	.....
180	78	3.28	3.43	5.70	3.60	3.47	.....
245	103	4.33	4.53	6.21	4.75	4.58	.....
287	119	5.00	5.24	7.19	5.50	5.26	6.35
336	138	5.80	6.07	8.35	6.37	6.11	.....
395	160	6.72	7.04	9.65	7.38	7.12	.....
		PAVING					
036P	17	$0.74	$0.77	$1.06	$0.81	$0.76	.....
053P	24	1.04	1.09	1.50	1.14	1.07	.....
072P	31	1.32	1.38	1.90	1.45	1.39	.....
097P	40	1.70	1.78	2.45	1.87	1.90	.....
049R	24	1.04	1.09	.....	1.14	1.07	.....
067R	31	1.32	1.38	.....	1.45	1.39	.....
089R	40	1.70	1.78	.....	1.87	1.90	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq.ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted:

Weight in pounds	New York	Birmingham	Chicago	St. Louis	San Francisco	Dallas
2.2	$19.00	$22.00	$19.00	$19.00	$19.00	$23.50
2.5	21.00	23.00	21.00	21.00	21.00	25.00
3.0	24.00	26.00	24.00	24.50	23.00	28.50
3.4	26.00	28.00	26.00	26.50	25.50	31.00

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Birmingham	Warehouse, Uncut: New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	$2.00	$2.25	$3.24	$3.00	$3.15	$3.38	$3.20
⅝	2.10	2.35	3.34	3.10	3.25	3.43	3.30
¾	2.20	2.45	3.44	3.20	3.35	3.48	3.40
⅞	2.40	2.65	3.64	3.40	3.55	3.63	3.60
1	3.00	3.25	4.24	4.00	4.15	3.78	4.20

For standard classification of extras for size and cutting of steel bars, see bar card of July 15, 1923.

ROLLED FROM RAILS

	St. Louis	Dallas		St. Louis	Dallas
½ and larger	$2.55	$2.80	½	$2.95	$3.02
⅝ in.	2.65	2.85	¼	3.55	3.20
¾	2.75	2.90		.....	.....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: May 6	One Month Ago	One Year Ago	Paving Block: 3-inch*	3½-inch*
New York (del.)	$20.50	$20.40	$17.00	$45.00	$51.00
New York (at dock)	17.25	17.00	15.00	.....	.....
Chicago	12.00	12.00	12.00	42.00	45.00
St. Louis, salmon (del.)	16.00	16.00	16.00	40.00	42.50
Denver, salmon	11@13	12.00	12.00	.....	.....
Dallas	12.00	11.10	12.10	35.00	.....
San Francisco	15.00	15.00	15.50	.....	.....
Los Angeles	11.50	11.50	13.00	(not used)	
Boston (del.)	18.00	18.00	18.00	45.00	50.00
Minneapolis (del.)	14.25	13.50@13.60	.....	.....	.....
Kansas City	15.00	15.50	14.50	(no market)	
Seattle	15.00	15.00	15.00	.....	42.50
Cincinnati	17.00	17.00	17.00	40.00	45.00
Montreal	20.25	20.25	17.50	100.00†	68.00
Detroit (del.)	16.00	16.00	17.50	38.40	41.50
Baltimore	18.00	18.00	18.00	40.00	45.00
Atlanta	10.50	10.50	10.50	40.00	.....
New Orleans	15.00	15.00	15.00	.....	50.00
Birmingham	12.50	12.50	12.50	40.00	45.00
Philadelphia	17@20	20@21	19.00	40.00	50.00
Pittsburgh (del.)	16.00	16.00	16.00	.....	.....
Cleveland	14.00	14.00	14.00	.....	.....

*For paving blocks 3x8½x4 and 3½x8½x4 respectively. †Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: May 6 on Trucks*†	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco†	Perth Amboy N. J., Factory*
4x12x12	$0.1112	$0.1162	$0.075	$0.12	$0.07	$0.108	.....
6x12x12	.1667	.1743	.096	.....	.094	.156	.....
8x12x12	.2084	.2179	.135	.22	.128	.244	.....
10x12x12	.....	.....	.167	.....	.155	.....	$0.252
12x12x12	.....	.....	.215	.....	.185	.....	.312

*5 per cent off for cash. †Partition tile.

	4x12x12	8x12x12	12x12x12
Boston	$0.085	$0.175	.....
Minneapolis (f.o.b. cars)	.068	.1175	$0.205
Minneapolis (delivered)	.076	.13	.225
Cincinnati	.07485	.13745	.....
Kansas City	.095	.175	.275
Denver	.075	.155	.188
Seattle (delivered)	.10	.20	.30
Los Angeles	.085	.172	.....
New Orleans	.13	.20	.35
Detroit (delivered)	.1095	.2821	.....
Montreal	.12	.27	.....
Baltimore	.125	.27	.....
Atlanta	.0895	.1837	.....
Dallas	.10	.19	.275
Birmingham	.11	.1824	.255
Pittsburgh (delivered)	.068	.128	.179
Cleveland	.07	.149	.....

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh Mill	Birmingham	Warehouse: New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90@2.00	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channels, 3 to 15 in.	1.90@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 16 in., ¼ in. thick	1.90@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	1.90@2.00	2.10	3.34	4.15	3.35	3.10	3.30
Plates, ¼ in. thick and heavier	1.90	2.00	3.34	4.15	3.25	3.10	3.30

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	Warehouse: New York, May 6	New York, One Yr. Ago	Chicago	St. Louis	San Francisco	Dallas
½ in.	$2.50@2.60	$4.50	$4.50	$3.50	$3.65	$5.00	$4.75
CONE HEAD BOILER							
½ in.	2.90	$4.70	$4.60	$3.70	$3.85	$5.20	$5.00
⅝ and ¾	3.05	4.85	4.75	3.80	4.20@4.45	5.35	5.15
⅞ and 1	3.30	5.10	5.00	4.05	4.60	5.60	5.50

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$2.85	$3.05	$3.75	$4.28	$2.93	$4.95
Cut	2.80	2.90	.....	5.00	5.00	3.15	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	San Francisco: Black	Seattle Black
½	$7.50	$5.75	$7.75
⅝	7.05	5.30	5.65
¾	6.90	5.15	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing in rolls of 108 sq.ft. costs $2.35@$2.50 per roll to contractors in carload lots f.o.b. New York.

Single shingles, slate finish, cost $7.00 per square (sufficient to cover 100 sq.ft.) in carload lots, f.o.b. New York. Strip shingles (4 in 1) f.o.b. New York, in carload lots to contractors, $5.00 per square.

ROOFING MATERIALS—Prices f.o.b. New York, to contractors in carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$70.00
Asphalt roofing (in barrels) per ton	25.00
Asphalt felt, per ton	72.00

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 83 per cent; "A," 87 per cent; "B," 89 per cent. Double thickness "AA," 82 per cent; "A," 86 per cent; "B," 89 per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.50	$3.60	$3.50	$3.75	$3.89
No. 12	2.55	3.65	3.55	3.80	3.94
No. 14	2.60	3.70	3.60	3.85	3.99
No. 16	2.70	3.80	3.70	3.95	4.09
Black					
*Nos. 18 to 20	3.05@3.15	4.40	3.90	4.55	4.30
*Nos. 22 to 24	3.10@3.20	4.45	3.95	4.60	4.35
*Nos. 26 and 27	3.15@3.25	4.50	4.00	4.65	4.40
*No. 28	3.25@3.35	4.60	4.10	4.75	4.50
Galvanized					
No. 10	3.50@3.60	4.70	4.25	5.00	4.65
Nos. 12 to 14	3.60@3.70	4.80	4.35	5.10	4.75
No. 16	3.75@3.85	.....	4.50	5.25	4.90
Nos. 18 to 20	3.90@4.00	5.10	4.65	5.40	5.05
Nos. 22 to 24	4.05@4.15	5.25	4.80	5.55	5.20
*Nos. 26 and 27	4.20@4.30	5.40	4.95	5.70	5.35
*No. 28	4.50@4.60	5.70	5.25	6.00	5.65

* For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: May 6	New York: One Year Ago	Chicago: May 6	Chicago: One Year Ago
Raw in barrels (5 bbl. lots)	$0.84½	$1.07	$0.87	$1.26

E. N.-R. Prices of Construction Materials

WHITE AND RED LEAD—Per 100-lb. keg, base price, f.o.b. New York:

	Dry		In Oil	
	May 6	1 Yr. Ago	May 6	1 Yr. Ago
Red	$15.25	$15.75	$16.75	$17.25
White	15.25	15.75	15.25	15.75

Lumber

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00
3x10 and 12	26.00	27.00	28.00	31.00
3x14	30.00	30.00	32.00	34.00
4x10 and 12	26.00	27.00	28.00	31.00
4x14	30.00	30.00	32.00	34.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	$28.00	$30.00	$32.00
6x14	34.00	36.00	38.00
8x10	28.00	30.00	32.00
8x14	34.00	36.00	38.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York		Chicago	
	20 Ft. and Under L.L.Y.P.	22-24 Ft. L.L.Y.P.	20 Ft. and Under No. 1 L.L.Y.P.	Up to 32 Ft. No. 1 Douglas Fir
3x4 to 8x8	$43.00	$44.00	$42.50	$41.00
3x10 to 10x10	50.00	51.00	47.50	41.00
3x12 to 12x12	57.00	58.00	57.50	41.00
3x14 to 14x14	65.00	66.00		41.00
3x16 to 16x16	77.00	78.00		42.00

New York—Wholesale price of long-leaf pine to dealers; to contractors, delivered from lighters or cars to job, $5@$10 additional. Short-leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 32 ft. and $1 for each additional foot from 32 to 36 Ft.

Other Cities

	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	$51.00	$48.50†	$51.00	$50.50	*$60.50*	$58.50†
Seattle		24.00				25.00
New Orleans	*57.00*				*53.00*	
Baltimore	32.50	49.25	53.00	60.00	38.00	49.75
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Montreal	50.00	58.00			60.00	65.00
Los Angeles		36.64				36.64
Denver		34.75	34.75	34.75		34.75
Minneapolis	42.00	**38.75**	35.00		44.00	**39.25**
Atlanta	31.00				34.00	
Dallas	56.00				56.00	
Kansas City, Mo.	29.00	**22.00**			44.00	21.00
Birmingham	32.00				34.00	
Philadelphia	54.00	36.00	38.00	45.00	65.00	36.00
Detroit	47.75	46.75			61.75	46.75
St. Louis	**42.25**				**54.25**	

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	$46.00	$42.50†	$45.00	*$50.00*	$48.00†
Seattle		20.00			24.00
New Orleans	*37.50*			**45.00**	
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	70.00	79.00	75.00	38.00	85.00
Montreal	45.00	50.00	40.00	65.00	50.00
Los Angeles		35.64			
Denver		33.25	**33.25**		**33.25**
Minneapolis	42.50	**36.75**	34.75	37.00	34.25
Atlanta	22.00			28.00	
Dallas	52.00			56.00	
Kansas City, Mo.	*38.50*	**25.00**		32.00	**21.50**
Birmingham	27.00			42.00	
Philadelphia	32.00	36.00	36.00	52.00	35.00
Detroit	39.75	37.00		46.50	41.25
St. Louis	41.00			30.00	

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M. ft. to contractors.
Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.
Denver—Quotes dealers price to contractors on large projects.
St. Louis—Wholesale price to contractors, f.o.b. cars, $2 per M.ft. additional.
Seattle—Price to contractors, delivered.
Dallas—Wholesale to contractors, $10 per M.ft. additional.
*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

Miscellaneous

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

May 6	One Month Ago	One Year Ago
$2.25@2.30	$2.25@$2.30	$2.15@2.25

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington: Discount 5 points less than discount for Eastern territory.
Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.
Arizona: Discount 10 points less than discount for Eastern territory.
Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.
North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¾-in., 8 ft.; ¾-in., 6; ¾-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0.20	New Orleans	$0.25½
New York	.26	Los Angeles	.25
Chicago	.25½	Seattle	.24
Minneapolis	.27½	St. Louis	.25½
San Francisco	.25	Montreal	.16
Atlanta	.27	Detroit	.27
Denver	.26@.28	Baltimore	.18
Cincinnati	.21	Kansas City	.28
Dallas	.31	Birmingham	.26@.27
Philadelphia	.26		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.265*	$0.287½*
Boston	.23	.255
Kansas City	.22	.235
Seattle	.165	.19
Chicago	.215*	.2375*
Minneapolis	.1917	.2123
St. Louis	.2275	.2525
Denver	.2025	.2275
Dallas	.225	.302
Los Angeles	.1875	.2225
Atlanta	.215	.24
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.195	.235
Birmingham	.22	.24
New Orleans	.233	.26
San Francisco	.1625	.1925
Philadelphia	.215	.24

*Special gelatin.

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f.o.b. works:

Sulphate of aluminum, in bags, per 100 lb.	$2.00@$2.10
Sulphate of copper, in bbl., per 100 lb.	4.40 @4.60
Soda ash, 58%, in bags, per 100 lb.	1.38@1.55
Chlorine, liquid, tanks, per lb.	.04@.04½
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	2.00@2.10

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Atlanta	$0.58	Detroit	$0.29
Baltimore	.31	Kansas City	.735
Birmingham	.58	New Orleans	.67
Boston	.365	New York	.34
Buffalo	.265	Pacific Coast (all rail)	1.15*
Chicago	.34	Philadelphia	.32
Cincinnati	.29	St. Louis	.43
Cleveland	.19	St. Paul	.60
Denver	1.15*		

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.